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Bay Delta Drinking Water Quality Criteria

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CALIFORNIA URBAN WATER AGENCIES

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Preface by California **Urban Water** Agencies

One objective of the CALFED Bay-Delta Program is to provide good water quality in Delta water diverted or exported to meet drinking water needs. To accomplish this, CALFED must select a long-term solution that provides a quality of source water that urban water providers can treat at reasonable cost to meet current and future federal and state health-based drinking water standards. To enable a quantitative assessment of the impact of alternative Bay-Delta solutions, specific water quality criteria must be chosen for analysis. Although there are numerous water quality constituents of concern in meeting drinking water standards, the major constituents of health concern in Delta water are pathogens (*Giardia* and *Cryptosporidium*) and disinfection by product (DBP) precursors (bromide and total organic carbon). The quality of water diverted from the Delta will bear heavily on the treatment technology which needs to be employed to meet increasingly stringent drinking water standards.

Setting water quality criteria requires knowledge about both the future regulatory setting under the Safe Drinking Water Act and the relative performance characteristics of currently available treatment technologies under a variety of actual conditions. Rather than asking its treatment experts to make this assessment, CUWA convened a panel of nationally recognized drinking water quality experts to determine the required criteria for total organic carbon (TOC) and bromide that will allow utilities treating Delta water to comply with current and probable future drinking water regulations utilizing available advanced technology. The expert panel consists of Douglas Owen, P.E. Vice President at Malcolm Pirnie, Inc., Phillippe Daniel, P.E. Associate at Camp Dresser & McKee and R. Scott Summers, PhD, Professor at the University of Cincinnati. The purpose of the expert panel report, which follows, is to identify Delta drinking water quality criteria based upon specified assumptions with which CALFED staff can evaluate the relative performance of Bay-Delta alternatives in meeting program objectives. These criteria have been developed in recognition of the interaction between source water quality, treatment efficacy and probable regulatory outcomes, as developed by the panel. This report does not represent CUWA's or any of its members endorsement of a specific regulatory outcome.

This report concludes that for currently available advanced water treatment technology to be able to meet probable future drinking water quality standards with water diverted from the Delta, the source water quality should have concentrations less than 3.0 mg/L for TOC and less than 50μg/L for bromide. CUWA recognizes that based upon historic concentrations of these constituents measured at Clifton Court Forebay in the Delta, it is unlikely that the criteria for bromide could be met under existing conditions, even in wet years. Therefore, CALFED must carefully analyze a variety of actions within its alternatives analysis to determine which combination of actions can assure the achievement of the program's drinking water quality objective in concert with other important objectives. These actions should include at least the following:

EXECUTIVE SUMMARY

The California Urban Water Agencies (CUWA) retained the assistance of three water quality and treatment specialists who have specific expertise in the formation of disinfection by-products (DBPs). These three individuals -- the expert panel -- evaluated specific source water quality characteristics which would be necessary to permit diverted water from the San Francisco Bay/Sacramento-San Joaquin River Delta (Delta) to be used for meeting future water quality standards under defined treatment conditions. Specifically, the expert panel was charged with 1) developing an anticipated future regulatory scenario, 2) defining treatment criteria for coagulation and ozonation processes which potentially could be implemented by users of Delta water, and 3) estimating source water quality diverted from the Delta which would allow users implementing the defined treatment technologies to comply with the regulatory scenario. The source water quality characteristics were framed in the context of total organic carbon (TOC) and bromide concentrations, both constituents which have the potential to be controlled by different management strategies for the Delta.

The potential regulatory scenario includes specific limits for two organic classifications of DBPs recently proposed in rulemaking by EPA; 40 μg/L for total trihalomethanes and 30 μg/L for the sum of five haloacetic acids. In addition, a potential limit of 5 μg/L was projected for bromate, an inorganic by-product formed by the ozonation of bromide-containing waters.

The treatment criteria specified by the expert panel included: 1) the use of 40 mg/L of alum at a pH of 7.0 and possibly as low as 6.5 in the coagulation process, followed by chlorine disinfection with a chloramine residual in the distribution system, and 2) the use of ozone at specific ozone:TOC ratios followed by a chloramine residual. The chlorine and ozone disinfection criteria were proposed to meet potential 1 or 2 log *Giardia* inactivation requirements. Only the ozone disinfection strategy was considered to provide potential 1 log *Cryptosporidium* inactivation.

The expert panel used data submitted by CUWA members, available literature and ongoing research, as well as their own experience and best professional judgement to arrive at potential source water quality requirements. Available models for DBP formation were evaluated to investigate threshold DBP formation behavior and to support the initial conclusions reached by the expert panel.

Specific combinations for TOC and bromide necessary in the water diverted from the Delta can vary depending upon the treatment technology implemented and microbiological inactivation required. Further, the conservatively plausible bromate level of 5 μg/L is significant in establishing limiting bromide levels in this evaluation. The rationale for this level in this analysis ultimately may be modified by a variety of factors including allowing for trade-offs for disinfection and the formation of organically-based brominated DBPs (e.g., THMs or HAAs) or evidence of a cancer threshold for bromate (investigations underway). On the other hand, there are other potential regulatory outcomes involving 1) the regulation of individual DBPs due to the potentially more severe health effects associated with brominated compounds, 2) the addition of other regulated haloacetic acids as analytical methods develop, and 3) the concerns over reproductive defects associated with DBPs, which may lower the regulatory levels and/or peak permissible concentrations.

1.0 INTRODUCTION

The California Urban Water Agencies (CUWA) engaged the services of three water quality experts to assist in providing input to the CALFED process regarding potential management alternatives in the San Francisco Bay/Sacramento-San Joaquin River Delta (Delta). The expert panel was charged with determining the required raw water quality diverted from the Delta which would permit the effective implementation of specific drinking water treatment processes to meet potential future drinking water quality standards. The expert panel was comprised of Douglas M. Owen, P.E., Vice President at Malcolm Pirnie, Inc., Phillippe A. Daniel, P.E., Associate at Camp, Dresser & McKee, and R. Scott Summers, PhD, Professor at the University of Cincinnati.

The expert panel used data submitted by CUWA members, available literature and ongoing research, as well as their own experience and best professional judgement to arrive at potential source water quality requirements. Available models for DBP formation were evaluated to investigate threshold DBP formation behavior and to support the preliminary conclusions reached by the expert panel. This report presents the best professional judgement from this expert panel.

This report is subdivided into the following chapters:

In Chapter 2, the general trends in drinking water regulations are discussed and plausible, future regulatory criteria are presented. Treatment processes relevant to users of water diverted from the Delta are presented in Chapter 3, together with general assumptions regarding the design and application of these processes. In Chapter 4, source water quality is projected which allows the treatment processes defined in Chapter 3 to be used to meet the potential regulatory scenario presented in Chapter 2.

Other water quality contaminants, such as pesticides, herbicides, and metals, are of concern but are not likely to constrain treatment requirements as significantly as the microbial and DBP regulations, based upon occurrence in water currently diverted from the Delta.

There are other potential regulatory outcomes involving 1) the regulation of individual DBPs (rather than the groups of compounds represented by TTHM and HAA5 due to the potentially more severe health effects associated with brominated compounds, 2) the addition of other regulated HAAs (there are nine total) as analytical methods develop, and 3) the concerns over reproductive and developmental effects that may be associated with DBPs, which may lower the regulatory levels and/or the permissible peak concentration (i.e., annual averaging may no longer be the basis for determining compliance).

Further, because of the analytical difficulty in accurately characterizing microbial contamination in water, EPA is considering a treatment optimization rule, at least on an initial basis, as opposed to specific criteria for pathogenic organisms. In such a rule, "optimization" may be defined as an improvement in treatment process efficiency which minimizes the risk of microbial contamination in treated water sources.

While there are many factors that contribute to the uncertainty surrounding the anticpated regulatory scenario, it is the selected bromate level of 5 µg/L that most keenly influences the analysis. The rationale for this level (i.e., advances in detection limit, the weight of the carcinogenic evidence, the precedence for THM and HAA5 limits in Stage 2 at half the Stage 1 levels) in this analysis could ultimately be modified by a variety of factors including:

- An allowance for disinfection - bromate trade-offs (this is the World Health Organization rationale for a 25 µg/L standard). This may be critical if an inactivation requirement for *Cryptosporidium* emerges.
- A bromate versus brominated organic compound trade-off (i.e., addressing the difference between DBPs formed with ozone versus those formed with chlorine).
- Evidence of a cancer threshold for bromate (investigations underway).

Nevertheless, in the absence of more definitive direction, the panel considers a 5 µg/L value to be both prudent and plausible.

For the purposes of this evaluation, the anticipated regulatory scenario summarized in Table 2.1 was used as the basis for evaluating source water quality and treatment requirements in this report:

TABLE 2.1

POTENTIAL REGULATORY SCENARIO

Regulation	Parameter	Treatment Requirement or MCL
ESWTR	*Giardia*	Additional 1 or 2 log inactivation by disinfection, after treatment removal credit
	Cryptosporidium	Additional 1 log inactivation by disinfection, after treatment removal credit
D/DBP Rule	TTHMs	40 µg/L
	HAA5	30 µg/L
	Bromate	5 µg/L

2.2 REGULATORY SCHEDULE

The recently-enacted 1996 Amendments to the Safe Drinking Water Act (SDWA) have caused EPA to adopt a more ambitious schedule than EPA presented in June 1996 (see Table 2.2). The June 1996 dates were based upon a scenario in which EPA would not be "pushed" to develop an Interim ESWTR, and promulgate Stage 1 of the D/DBP Rule and the Interim ESWTR, until pathogen data were available from the Information Collection Rule (ICR).

TABLE 2.2

COMPARISON OF OLD AND NEW REGULATORY SCHEDULE REGULATION

Regulation	Promulgation Date	
	Initial (June 1996)	Revised (August 1996)
Interim ESWTR	June 2000	November 1998
Final ESWTR	NA [(1)]	November 2000
Stage 1 D/DBP Rule	June 2000	November 1998
Stage 2 D/DBP Rule	June 2003	May 2002

Notes: (1) NA = Not available

EPA understands, however, that the Final ESWTR and Stage 2 of the D/DBP Rule, at a minimum, are linked to data availability through the ICR. Monitoring for the 18-month ICR won't begin until February 1997. Consequently, EPA is pressed between the statutory requirements and the recognition that a longer time frame would be required [e.g., promulgation (final) Stage 1 of the D/DBP Rule and Interim ESWTR in 2000 with final and effective dates for Stage 2 in 2003 and 2006 to 2008, respectively]. One possible alternative for EPA is to proceed with interim regulations for microbial and DBP control (i.e., an ESWTR focusing on "optimization" and potential elements of the Stage 1 D/DBP Rule) that would be promulgated in November 1998. In any case, both the ESWTR and Stage 2 of the D/DBP Rule would ultimately need to be finalized and become effective by the dates given in the reauthorized SDWA (November 2000 and May 2002, respectively).

Given this projected time frame, it is anticipated that the selected option for management alternatives in the Delta will be known, with construction underway, by the time the entities using Delta water need to implement required treatment technologies. Consequently, these agencies will be in a position to plan for the projected water quality from the Delta "fix" in coordination with their efforts for facility modifications to meet the regulatory requirements of the final ESWTR and Stage 2 of the D/DBP Rule.

3.0 TREATMENT PROCESSES REQUIRED TO MEET FUTURE REGULATIONS

In this chapter, general process criteria are defined to characterize specific treatment processes relevant to users of water diverted from the Delta. Source water quality is determined in Chapter 4 which permits these treatment processes to meet the regulatory scenario discussed in Chapter 2.

3.1 SELECTION OF TREATMENT PROCESSES TO BE EVALUATED

As a part of this effort, CUWA requested that the expert panel focus on those treatment processes which were considered to be the most cost-effective for simultaneously meeting the requirements of the D/DBP Rule and the ESWTR when treating water diverted from the Delta. These processes were defined as enhanced coagulation, a treatment technique proposed for Stage 1 of the D/DBP Rule, and ozone disinfection. These processes are also relevant for Stage 2 of the D/DBP Rule and were considered appropriate because they can be implemented into facilities currently owned and operated by the CUWA agencies (as well as a majority of conventional filtration facilities across the country). For example, the majority of filtration systems across the country use conventional treatment including sedimentation, which allows for increased coagulation dosages to meet proposed enhanced coagulation requirements. In addition, some CUWA facilities already use ozone disinfection. The most cost-effective option(s) for meeting potential future regulations is specific for each water purveyor, depending upon water source and quality.

There are entities which currently treat much higher quality water than that currently diverted from the Delta. These entities are able to use in-line filtration or simply disinfection without filtration to produce high quality drinking water. It should be emphasized that the determination of feasible treatment processes is dependent upon the existing source and that this evaluation is based only upon those entities currently using water diverted from the Delta as a source.

The use of post-filter granular activated carbon (GAC) adsorbers and membranes were not considered a part of this evaluation. The focus in this study was to define the source water quality needs for technologies currently applicable to large scale water treatment facilities in California. Post-filter GAC adsorbers and membranes can be at least an order of magnitude more expensive than ozone and the feasibility of these technologies is much more uncertain based upon cost, environmental permitting constraints, and availability of residual handling alternatives. This position is shared by much of the water industry. For reference, only one treatment plant in the country at the size comparable to many of the CUWA members uses post-filter GAC as a treatment technique. There are no membrane plants in operation in the country which are used for DBP precursor removal at the facility sizes representative of the CUWA members.

It should be noted, however, that source water quality constraints from the Delta could be modified if GAC and membrane treatment ultimately were considered to be feasible treatment technologies.

3.2 GENERAL ASSUMPTIONS FOR SELECTED TREATMENT PROCESSES

3.2.1 Enhanced Coagulation

Enhanced coagulation offers the advantages of removing naturally-occurring organic material, thereby removing DBP precursors which, upon disinfection, form DBPs. As such, MCLs for TTHMs and HAA5 can be addressed by enhanced coagulation, when followed by chlorine disinfection. Upon review of the potential for DBP formation, it was determined that enhanced coagulation would only be required under conditions in which free chlorine is used for primary disinfection (pathogen inactivation), followed by chloramines for secondary disinfection to maintain a distribution system residual. Further, this treatment option is only applicable to instances in which either 1 or 2 log *Giardia* inactivation is required to demonstrate microbial control, as discussed in Chapter 2. It was assumed that *Cryptosporidium* inactivation could not be achieved by free chlorine disinfection under treatment conditions feasible for drinking water systems.

The conditions for enhanced coagulation were defined according to the specific percent removal requirements for Total Organic Carbon (TOC), as dictated in Stage 1 of the proposed D/DBP Rule (USEPA, 1994), by raw water TOC and alkalinity. Given the specific TOC removal percentages in the proposed D/DBP Rule, this translated to a projected 40 mg/L dosage of alum at a coagulation pH of 7.0, and possibly as low as 6.5. Consequently, acid addition may be required since the 40 mg/L dosage will likely only lower the pH to a value between 7.0 and 7.2. These coagulant dosages are not atypical of those currently being used by some CUWA members (e.g., Alameda County, Contra Costa, and Santa Clara Valley Water Districts), although 1) these systems do not reduce pH with acid to improve precursor removal, and 2) many systems still prechlorinate, which cannot be used to obtain disinfection credit in the proposed D/DBP rule when using enhanced coagulation . It was assumed that a chlorine:TOC ratio of 1:1 and 60 minutes of free chlorine contact (t_{50}) would be required to achieve 1 log inactivation of *Giardia*. For 2 log *Giardia* inactivation, 120 minutes of free chlorine contact would be required.

3.2.2 Ozone Disinfection

The use of ozone disinfection offers the opportunity to meet the MCLs for TTHM and HAA5 in the potential regulatory scenario by again using chloramines as the secondary disinfectant. Therefore, additional removal of naturally-occurring organic matter may not be necessary. That is, enhanced coagulation may not have to be coupled with ozone disinfection, as long as the source water TOC is $\leq$ 4.0 mg/L and alkalinity is > 60 mg/L as $CaCO_3$. Implementing ozone and chloramines under the Stage 1 timeframe to meet both Stage 1 and Stage 2 MCLs is one strategy for water utilities to avoid implementing enhanced coagulation when treating source waters with TOC concentrations $\leq$ 4.0 mg/L and alkalinity > 60 mg/L as $CaCO_3$. Many entities using water diverted from the Delta, however, treat source water TOC concentrations > 4 mg/L.

For the purposes of evaluating bromate formation for 1 log *Giardia*, 2 log *Giardia*, and 1 log *Cryptosporidium* inactivation, ozone doses were projected based upon the expert panel's experience, current research, and data submitted by the CUWA members. The ratios were adjusted for pH effects (i.e., greater ozone residual persistence as pH decreases resulting in lower ozone requirements). For example, to meet 1 log *Giardia* inactivation at ambient pH, Alameda County Water District routinely requires an ozone to TOC ratio of 0.8 (ambient pH for entities using water diverted from the Delta can range from 7.5 to 9.5, a "typical" value of 7.8 was used in this analysis). At pH 7, MWD's demonstration plant results indicated roughly a 0.7 ozone:TOC ratio for achieving 2 log *Giardia* inactivation. Pilot results from the Santa Clara Valley Water District indicated that at pH 6.6 to 6.8, an ozone:TOC ratio of 0.7 to 0.9 was required for 1 log *Cryptosporidium* inactivation (the data were variable, however, and the lower pH did not necessarily correspond to lower ozone:TOC ratios for the pilot results).

Based upon the ozone dosage and inactivation data from the CUWA members and the expert panel's experience, possible ozone:TOC ratios which may be required to achieve pathogen inactivation were evaluated to take into account potential lower ozone dosages to achieve a given inactivation under conditions of lower TOC (for example, settled water ozonation). It is important to note that CT compliance needs to be achieved continuously, and therefore an approximate 20 percent safety factor was applied to the CUWA member data. This also partially accounts for EPA's approach in setting CT values based upon 90 percentile values versus median, or 50 percentile values which are represented by the CUWA member data. The selection of ozone:TOC ratios also considered operational issues, for which it was assumed that there would be a certain "overshoot" of specific dosage targets to ensure continual CT compliance. Based upon these assumptions, bromate formation was evaluated at a range of ozone:TOC ratios and pH values, as indicated in Table 3.1.

TABLE 3.1

OZONE:TOC RATIO AND PH CONDITIONS FOR BROMATE EVALUATION

pH	Ozone:TOC Ratios
7.8	0.8, 1.2, 1.5
7.2	0.7, 1.0, 1.3
6.8	0.6, 0.9, 1.1
6.5	0.5, 0.75, 1.0

The ozone:TOC ratios at each pH were considered to inactivate 1 log *Giardia*, 2 log *Giardia*, and 1 log *Cryptosporidium*.

4.0 EVALUATION OF SOURCE WATER QUALITY AND TREATMENT EFFICIENCY

4.1 WATER QUALITY IMPACTS AND VARIABILITY

In this section, water quality constraints are described which will allow implementation of specific treatment processes to meet potential regulatory goals. In general, the water quality constraints will be described in terms of two measurable surrogate parameters which affect DBP formation; TOC and bromide. In evaluating these water quality variables and interpreting the results, it is important to recognize that:

1. TOC is a heterogeneous mixture, and is comprised of humic and fulvic acids and other naturally-occurring organic material which varies from source to source and from location to location within a source. Consequently, TOC from different regions of the Delta will not have an identical impact on DBP formation. In this effort, it was necessary to assume that TOC could be a unifying variable for organic DBP precursor material, even given the inherent variability in the material which comprises this parameter.

2. The extent to which bromide participates in DBP reactions is dependent upon its oxidation state as well as its relative concentration with other competing oxidants (e.g., chlorine). The following analysis is not stoichiometrically-based, but rather is empirical in nature based upon measured formation rates and other data available to the Panel.

3. The formation of DBPs is dependent upon many other water quality parameters beyond TOC and bromide, alone. Some of these include temperature and pH. The Panel focused on TOC and bromide because it was assumed that management alternatives for the Delta had the opportunity to affect these variables, and therefore their control will influence subsequent DBP formation through treatment processes.

4.2 ENHANCED COAGULATION

For enhanced coagulation, source water TOC concentrations of 3, 4 and 5 mg/L and bromide concentrations of 50, 100, 150, 200 and 300 μg/L were evaluated. As discussed in Chapter 3, an alum dose of 40 mg/L at a coagulation pH of 7.0, and possibly as low as 6.5, was projected to be required to meet the 30% TOC removal requirement for a raw water TOC of $\leq$ 4 mg/L and 35% TOC removal requirement for a raw water TOC of > 4 mg/L. These removals result in the treated water TOC values listed in Table 4.1. Using free chlorine as a disinfectant, a chlorine-to-TOC ratio of 1:1 and contact times of 1 and 2 hours were projected to yield 1 and 2 log *Giardia* inactivation, respectively. To assist in assessing the TTHMs formed under these conditions, a THM formation model developed for the Metropolitan Water District of Southern California was used (Malcolm Pirnie Inc., 1993). The model was developed from 648 data observations under bench-scale conditions using various blends of water diverted from the Delta. The conditions used in this evaluation were within the experimental boundaries of the model. A more detailed description of the model is provided in Appendix A. The predicted TTHM values are summarized in Table 4.1.

TABLE 4.1

PROJECTED TTHM FORMATION USING ENHANCED COAGULATION

Water Quality			TTHM Formation (μg/L)	
Raw TOC (mg/L)	Treated TOC (mg/L)	Bromide (μg/L)	1 hr. contact	2 hr. contact
3	2.1	50	24	29
		100	27	32
		150	30	35
		200	32	38
		300	38	45
4	2.8	50	32	38
		100	35	42
		150	39	46
		200	42	50
		300	49	59
5	3.25	50	37	44
		100	40	48
		150	44	53
		200	48	57
		300	57	68

The TTHM values were compared to the data supplied by the CUWA members, those in the open literature, and with the experience of the expert panel. A summary of the data provided by the CUWA members is included in Appendix B. The available data and the expert panel's experience agreed well with values in Table 4.1.

HAAs are also formed under these reaction conditions. The Stage 2 proposed MCLs of 40 μg/L and 30 μg/L for TTHM and HAA5, respectively, yield a mass concentration TTHM-to-HAA5 ratio of 1:0.75. The DBP data supplied to the expert panel by the CUWA members indicate that the TTHM values exceed the HAA5 concentrations by greater than this ratio of 1:0.75 in 84% of the 160 cases where paired TTHM and HAA5 data were available. Other data from both research and full-scale applications in waters containing at least 50 μg/L of bromide confirm these findings (Summers, et. al., 1996, Cheng, et. al., 1995, Shukairy, et.al., 1994). Thus, it was concluded that TTHMs are the DBP of regulatory concern for this coagulation evaluation. It is important to note, however, that HAA5 represents only five of the nine bromo-chloro HAA compounds. If HAA6 or even HAA9 were to become regulated, then the controlling parameters and values could be affected.

A 20 percent safety factor on DBP production was used in determining the source water conditions which would result in the target DBP concentrations following treatment, thus a target value of 32 μg/L was used for TTHM (80% of 40 μg/L). Based upon this assumption, the following conclusions were drawn:

1) For a 1 log *Giardia* inactivation using free chlorine for 60 minutes following enhanced coagulation, it was projected that the following water quality conditions would permit compliance with the TTHM target concentrations in the regulatory scenario:

    - a raw water TOC concentration < 3.0 mg/L and a bromide concentration < 200 μg/L (0.20 mg/L)

    - a raw water TOC concentration < 4.0 mg/L and a bromide concentration < 50 μg/L (0.05 mg/L)

    Certain combinations of raw TOC concentrations between 3 and 4 mg/L and bromide concentrations between 200 μg/L and 50 μg/L are also projected to meet the target DBP values.

2) For a 2 log *Giardia* inactivation using free chlorine for 120 minutes following enhanced coagulation, it was projected that a raw water TOC concentration < 3.0 mg/L and a bromide concentration < 100 μg/L (0.10 mg/L) would permit compliance with the TTHM target concentrations in the regulatory scenario.

4.3 OZONATION

The formation of bromate by ozone has come into focus only recently and the ultimate MCL for this compound is of critical importance to facilities which have bromide in their source water and are currently using, or anticipating the use of, ozone for drinking water treatment. Even small concentrations of bromide (< 50 μg/L) can result in measurable concentrations of bromate after ozonation. Therefore, the Panel carefully evaluated available data from the CUWA members, other available literature, and ongoing research on bromate formation to evaluate potential source water constraints. Based upon these data, the expert panel arrived at initial conclusions regarding potential source water bromide concentrations which would be required to limit bromate formation within the potential regulatory scenario in Chapter 2.

Unfortunately, bromate formation is strongly dependent upon the nature of the experimental system design (e.g., bench versus pilot or full-scale). In addition, bromate formation depends upon ozone dosage and residual, which is often specific for full-scale facilities, making the direct comparison of these data difficult. Therefore, a bromate model (Ozekin, 1994) was utilized to systematically evaluate the impact of ozone dose, bromide, TOC and pH on the formation of bromate and thereby supplement the available literature (Shukairy et.al., 1994), data supplied by the Alameda County Water District, Contra Costa Water District, Santa Clara Valley Water District, and Metropolitan Water District of Southern California and the expert panel's experience. The model was developed from data from several source waters including water diverted from the Delta, including results from source waters containing bromide concentrations between 70 μg/L and 440 μg/L. A contact time of 12 minutes was chosen and the concentrations of TOC, bromide, ozone dose and pH were varied over representative ranges as discussed in Chapter 3. At each pH, three ozone:TOC ratios were estimated to provide the following levels of inactivation; 1 log *Giardia,* 2 log *Giardia* and 1 log *Cryptosporidium*. The dose of ozone estimated for these inactivations decreases with decreasing pH as a higher ozone residual is maintained at the lower pHs. The results of the modeling supported the initial conclusions reached by the Panel based upon the available literature and review of the CUWA data. A more detailed description of the model is provided in Appendix A.

Bromate formation is the limiting DBP (as opposed to TTHM and HAA5) for the ozone treatment and disinfection strategy specified in this evaluation. It is the opinion of the Panel that the controlling source water quality parameter for the formation of bromate, in the context of this evaluation, is bromide. It is recognized that higher concentrations of TOC will result in higher ozone dosages to achieve a given CT, and, as a result, may increase the concentration of bromate formed depending upon ozone residual, bromide concentration and potentially other parameters such as contactor design. Higher ozone dosages as a result of higher TOC also result in increased capital and operational costs for ozone treatment. Further, TOC can also be limiting to the extent that the biodegradable material, formed by the reaction between ozone and naturally-occuring organic mater (NOM), is not completely controlled through biofiltration, thereby creating an undesirable regrowth potential in the distribution system. The extent to which regrowth will be a problem is a function of the distribution system design, as well as disinfectant residuals maintained and other water quality parameters which are agency-specific. Nevertheless, sufficient data were not available to isolate the impact of TOC on bromate formation, in the absence of variation in bromide, pH and other water quality factors.

Based upon the data supplied by the CUWA members and other bromate formation studies and the model results, the expert panel concluded:

1) A bromate standard of 5 µg/L is very restrictive at pH values above 7. At pH 7.8 (ambient for some preozonated waters) it is projected that this standard will not be met and that a bromide level of 50 to possibly 100 µg/L would be needed to meet a bromate standard of 10 µg/L for 1 log *Giardia* inactivation.

2) If the ozonation pH were reduced to 6.8, then:

- a 5 µg/L level of bromate may be achievable with 1 log *Giardia* inactivation in the bromide range of 50 to possibly 150 µg/L

- a 10 µg/L level of bromate may be achievable with 2 log *Giardia* inactivation in the bromide range of 50 to 150 µg/L, or 1 log *Cryptosporidium* inactivation with a bromide concentration of 50 to possibly 100 µg/L.

3) It is projected that if the pH were depressed to 6.5, then a bromide concentration of 100 to possibly 150 µg/L could be accommodated while maintaining a bromate standard of 5 µg/L when achieving a 2 log *Giardia* inactivation. For 1 log *Cryptosporidium* inactivation, a maximum bromide concentration of 50 to possibly < 100 µg/L might be tolerated.

4) Limiting TOC concentrations were not estimated because of the limited availability and robustness of the data illustrating the impact of TOC on bromate formation, in the presence of bromide. It should be recognized, however, that higher TOC concentrations translate to higher ozone dosages to meet a given disinfection criterion and thereby can result in higher bromate formation. This is empirically validated in reviewing bromate formed during settled water ozonation as opposed to raw water ozonation. When TOC concentrations typically are lower at a given facility, ozone dosages to achieve a given disinfection requirement are lower, and measured bromate concentrations are lower. Lower pH in settled water also helps reduce bromate concentrations.

The expert panel recognizes that there are variations in bromate production data and therefore looked for indications relating to threshold behavior. That is, evaluating source water bromide concentrations which result in a clear increase in bromate concentrations for a given set of ozonation conditions. Given some variation in the formation of bromate reported at lower source water bromide concentrations (< 50 μg/L), the expert panel took a position of plausible conservatism.

4.3 SUMMARY

Table 4.2 summarizes projected source water quality requirements for TOC and bromide, depending upon the technology applied. In reviewing the values presented in this table, it is evident that there are various water quality constraints for TOC and bromide depending upon the technology used and the level of microbiological inactivation required. As stated previously, which technology is implemented is agency-specific, and is dependent upon a host of constraints related to cost, permitting issues and residual disposal. In some instances, lowering the ozonation pH with acid may not be feasible as a result of the inability to transport and store the chemicals necessary. Lower pH could also have an impact on the structural integrity of concrete basins, such as flocculation basins, sedimentation basins, and ozone contactors. On the other hand, ozonating at a pH of 7.0 to 7.2 may be possible without acid feed if settled water ozonation can be implemented. Existing plant hydraulic conditions and site issues affect this alternative.

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TABLE 4.2

SUMMARY OF SOURCE WATER QUALITY CONSTRAINTS[1]

TREATMENT SCENARIO / DISINFECTION STRATEGY	MICROBIAL INACTIVATION REQUIRED					
	1 Log *Giardia* Inactivation		2 Log *Giardia* Inactivation		1 Log *Cryptosporidium* Inactivation	
	TOC (mg/L)	Bromide (μg/L)	TOC (mg/L)	Bromide (μg/L)	TOC (mg/L)	Bromide (μg/L)
Enhanced coagulation free chlorine/chloramines	< 3.0 or < 4.0	< 200 or < 50	< 3.0	< 100	N/A[2]	N/A[2]
Ozonation at pH 7.8 w/chloramines	N/E [4]	N/A[3]	N/E [4]	N/A[3]	N/E [4]	N/A[3]
Ozonation at pH 6.8 w/chloramines	N/E [4]	< 150	N/E [4]	< 50	N/E [4]	N/A[3]
Ozonation at pH 6.5 w/chloramines	N/E [4]	< 200 to 250	N/E [4]	<100 to 150	N/E [4]	< 50

Notes:
1. Source water quality constraints are based upon achieving 40 μg/L of TTHM, 30 μg/L of HAA5, and 5 μg/L of bromate using the treatment and disinfection conditions presented in Chapter 3.
2. N/A = Not achievable. At this time, it is considered that free chlorine can not inactivate *Cryptosporidium* at dosages practical in water treatment.
3. N/A = Not achievable. Bromide concentrations would have to be considerably less than 50 μg/L to achieve a bromate concentration of 5 μg/L. Data to determine the necessary bromide concentration relevant to this study were not available.
4. N/E = Not estimated. Limiting TOC concentrations were not estimated because of the limited availability and robustness of the data illustrating the impact of TOC on bromate formation, in the presence of bromide. It should be recognized, however, that higher TOC concentrations translate to higher ozone dosages to meet a given disinfection criterion and thereby can result in higher bromate formation.

The Panel is also aware of the significance of bromate in establishing limiting bromide levels in this evaluation. There are many factors that contribute to the uncertainty surrounding the projected numbers, including relatively few studies which have evaluated bromate formation in low bromide waters (< 50 μg/L), variations in treatment conditions which may reduce bromate formation (e.g., using both pre- and post-ozonation to reduce ozone dosages at any single location), and potentially lower CT values for ozone. It is the selected conservative (but plausible) level of 5 μg/L, however, that most keenly influences the analysis. The rationale for this level (i.e., advances in detection limit, the weight of the carcinogenic evidence, the precedence for THM and HAA5 limits in Stage 2 at half the Stage 1 levels) in this analysis may be modified by a variety of factors including:

- An allowance for disinfection - bromate trade-offs (this is the World Health Organization rationale for a 25 μg/L standard). This may be critical if an inactivation requirement for

Cryptosporidium emerges.

- A bromate versus brominated organic compound trade-off (i.e., addressing the difference between DBPs formed with ozone versus those formed with chlorine).
- Evidence of a cancer threshold for bromate (investigations underway).

On the other hand, there are other potential regulatory outcomes involving 1) the regulation of individual DBPs (rather than the groups of compounds represented by TTHM and HAA5) due to the potentially more severe health effects associated with brominated compounds, 2) the addition of other regulated HAAs (there are nine total) as analytical methods develop, and 3) the concerns over reproductive defects associated with DBPs, which may lower the regulatory levels and/or peak permissible concentrations (i.e., annual averaging may no longer be the basis for determining compliance).

Given this understanding, if flexibility were provided to all agencies to implement any of the technologies evaluated in this study to meet the potential future regulatory scenario, then it is projected that a TOC of < 3.0 mg/L and a bromide of < 50 µg/L in water diverted from the Delta would be necessary. The TOC value is constrained by the formation of total trihalomethanes when using of enhanced coagulation for TOC removal and free chlorine to inactivate *Giardia.* The bromide value is contrained by the formation of bromate when using ozone to inactivate *Cryptosporidium*.

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C-031035

APPENDIX A

PREDICTIVE MODELS FOR DISINFECTION BY-PRODUCTS

A.1 THM PREDICTIVE EQUATIONS

Malcolm Pirnie, Inc. (1993) undertook a study on the formation of DBPs in chlorinated waters over a wide range of TOC and bromide concentrations for the Metropolitan Water District of Southern California. A 5 by 5 matrix of discrete samples containing incremental increases in TOC and bromide concentrations were prepared and evaluated. For this study, water was synthesized using low-TOC, low bromide Sacramento River water and high-TOC agricultural drainage water. High-bromide concentrations were achieved by adding sodium bromide.

The database used in this study, consisting of more than 900 observations, was constructed based upon the results of the source water quality monitoring program and the chlorination experiments from the 5 by 5 matrix. One portion of the database represented THM formation in jar-treated waters and another portion represented THM formation in 0.45 μm membrane filtered raw water.

Three sets of THM predictive equations were developed during this study using a non-linear power function format including total organic carbon (TOC), ultraviolet absorbance at 254 nm (UV-254), chlorine dose, bromide concentration, reaction time, temperature and pH as independent variables. The final TTHM predictive equation was based upon a portion of the database representing THM formation in 0.45 μm membrane filtered raw water (approximately 650 observations). Predictive capabilities of this equation was compared with THM formation in the jar-treated water (approximately 250 observations). The final TTHM equation developed was:

$$\text{TTHM} = 7.21\ \text{TOC}^{0.004}\ \text{UV254}^{0.534}\ (\text{ClDOSE}-7.6{*}\text{NH}_3\text{-N})^{0.224}\ \text{TIME}^{0.255}\ (\text{Br}+1)^{2.01}\ (\text{pH}-2.6)^{0.719}\ \text{TEMP}^{0.480}$$

$$[r^2 = 0.96, F = 2010, p < 0.001]$$

This equation was developed at TOC concentrations ranging between 1.1 and 7.6 mg/L, bromide between 10 and 800 μg/L, contact times between 1 and 48 hours, and chlorine doses between 1.0 to 16.4 mg/L. The values for UV-254 to be input into the TTHM equation were predicted using a relationship between TOC and UV-254 developed in the study as follows:

$$UV\text{-}254 = -0.0224 + (0.0374)(TOC)$$
$$(r^2 = 0.92)$$

Using free chlorine as a disinfectant, a chlorine-to-TOC ratio of 1:1 and contact times of 1 and 2 hours were projected to yield 1 and 2 log *Giardia* inactivation, respectively. A temperature of 20 ° C and pH of 7 was also input to this equation to yield the values in Table 4.1 in the body of this report.

A.2 BROMATE PREDICTIVE EQUATION

The bromate model of Ozekin and Amy (Ozekin, 1994) was utilized to systematically evaluate the impact of ozone dose, bromide, DOC and pH on the formation of bromate. The model was developed from data from several source waters including waters diverted from the Delta. Source water bromide concentrations ranged between 70 and 440 µg/L with bromate concentrations ranging between 2 and 314 µg/L.

The model used has the following form:

$$BrO_3 = 1.63x10^{-6}\ DOC^{-1.26}\ pH^{5.82}\ (O_3\ dose)^{1.57}\ Br^{0.73}\ time^{0.28}$$

A contact time of 12 minutes was chosen and the concentrations of DOC, bromide, ozone dose and pH were varied over a representative range as input to the above equation. Temperature was held constant at 20 ° C. The bromate formation results are shown in Table A.1.

It is important to note that the model was only used to support conclusions reached by the expert panel prior to using the model. The bromate model was evaluated to investigate threshold behavior regarding formation at specific levels and to support the initial conclusions reached by the expert panel. The results of the modeling should not be overemphasized. The results of the modeling supported the initial conclusions reached by the Panel based upon the available literature and review of the CUWA data.

TABLE A.1

PREDICTED BROMATE FORMATION

TOC (mg/L)	Br (µg/L)	O3:TOC at pH 7.8			O3:TOC at pH 7.2			O3:TOC at pH 6.8			O3:TOC at pH 6.5		
		0.8(1)	1.2(2)	1.5(3)	0.7(1)	1(2)	1.3(3)	0.6(1)	0.9(2)	1.1(3)	0.5(1)	0.75(2)	1(3)
2	50	8	15	21	4	7	10	2	4	6	1	2	4
	100	13	24	34	7	11	17	4	7	10	2	4	6
	150	17	33	46	9	15	23	5	9	13	3	5	8
	200	21	40	57	11	19	29	6	12	16	4	7	10
2.5	50	8	16	22	4	7	11	2	4	6	1	3	4
	100	14	26	37	7	12	18	4	7	10	2	4	7
	150	18	35	50	9	16	25	5	10	14	3	6	9
	200	23	43	61	12	20	31	7	12	17	4	7	11
3	50	9	17	23	4	8	12	3	5	6	1	3	4
	100	15	27	39	7	13	20	4	8	11	2	5	7
	150	20	37	52	10	17	26	6	11	14	3	6	10
	200	24	46	65	12	21	2	7	13	18	4	8	12
4	50	10	18	26	5	9	13	3	5	7	2	3	5
	100	16	30	43	8	14	21	5	9	12	3	5	8
	150	21	40	57	11	19	29	6	12	16	4	7	10
	200	26	50	71	13	23	35	8	14	20	4	8	13

Notes:
1. Ozone:TOC ratio anticipated to achieve 1 log *Giardia* inactivation.
2. Ozone:TOC ratio anticipated to achieve 2 log *Giardia* inactivation.
3. Ozone:TOC ratio anticipated to achieve 1 log *Cryptosporidium* inactivation.

APPENDIX B

CUWA MEMBER TREATMENT DATA

Data was provided by the CUWA members, including those resulting from the operation of their treatment facilities as well as bench and pilot studies. There are variations in these data which are unique to each treatment system. For example, some systems supplied data representing ozonation of only raw water, while others supplied data with both pre- and post-ozonation. The expert panel recognizes that there are unique aspects of process operation which can affect the ultimate formation of DBPs. For this study, however, the expert panel defined "unifying criteria" in Chapter 3 for enhanced coagulation and ozone which allow a comparison of these processes and a systematic method by which to evaluate the impact of water quality constraints on DBP formation. This appendix contains the data supplied by the CUWA members.

Contra Costa WD							
Randall-Bold WTP							
Sample	Bromate	Chloride	Bromide				
Date	(measured)	(daily avg)	(estimated)				
	(µg/L)	(mg/L)	(mg/L)				
2/23/93	<0.5	72	0.22				
4/6/93	<1.4	89	0.27				
5/21/93	10	55	0.17				
6/15/93	6	30	<0.1				
8/18/93	6	25	<0.1				
10/5/93	10.3	60	0.18				
11/17/93	30.4	142	0.43				
1/4/94	1.5	70	0.21				
2/9/94	4.6	70	0.21				
3/1/94	2.6	55	0.17				
4/5/94	7.3	77	0.23				
5/10/94	<3	57	0.17				
7/12/94	<5	112	0.34				
8/9/94	<5	133	0.4				
10/4/94	51	158	0.48				
10/10/94	33	118	0.36				
11/1/94	15	150	0.45				
12/6/94	13	162	0.49				
1/10/95	5.7	94	0.28				
2/14/95	17	60	0.18				
3/14/95	7.6	35	0.11				
4/4/95	18	105	0.32				
6/13/95	<5	40	0.12				
7/11/95	21	32	0.1				
8/8/95	7.8	32	0.1				
9/19/95	<5	16	<0.1				
10/3/95	<5	14	<0.1				
11/7/95	<5	16	<0.1				
12/12/95	<5	23	<0.1				
2/6/96	<5	40	0.12				
3/5/96	<5	117	0.35				
Note:	Ozone	dose	currently	optimized	for	coagulation,	
	not	bromate	production.				
Conservative	ozone	doses:	pre-ozone	2.5-3 ppm	(raw water		
			post-ozone	1ppm	(filtered)		
Plant CT operating	from 2-5						

C-031040

ont

Utility ID:	CCWD: Randall-Bold WTP	(ACWD, CCWD, EBMUD, MWD, SCVWD)	
1. Study ID:	Historical data 7/1/95-6/30/96	(Optimization Study 8/95, etc.)	4. If blended source water indicate sources and proportions:
2. Source water:	Delta (Rock Slough)	(River, lake, groundwater, etc.)	Source — %
3. Source water ID:	Central Valley Project Water	(State Project water, blend of...., etc.)	
	5. Describe level of study:		Bench-scale
	(Indicate with an 'X')		Pilot-scale
		x	Full-scale

WATER QUALITY DATA: CONVENTIONAL+OZONE

Date	Time	TOC (mg/L) Raw	TOC Settl.	TOC Ozon.	TOC Filt.	UV-254 (1/cm) Raw	UV-254 Settl.	UV-254 Ozon.	UV-254 Filt.	Alkalinity (mg/L as CaCO3) Raw	Alkalinity Settl.	Alkalinity Ozon.	Alkalinity Filt.
7/10/95		5 7								37			21
8/7/95		3 6								36			20
9/11/95		7.7								55			48
10/2/95		3								58			49
11/6/95		2.8								52			43
12/4/95		3								55			35
1/8/96		5 5								62			40
2/5/96		6.9								71			36
3/4/96		5.1								107			87
4/1/96		7.8								83			63
5/6/96										69			51
6/3/96		4.1								47			35

Date	Hardness (mg/L as CaCO3) Total Raw	Total Settl.	Total Ozon.	Total Filt.	Calcium Raw	Calcium Settl.	Calcium Ozon.	Calcium Filt.	Bromide (µg/L) Raw	Bromide Settl.	Bromide Ozon.	Bromide Filt.	Ammonia (mg NH3-N/L) Raw	Ammonia Settl.	Ammonia Ozon.	Ammonia Filt.	Chl (mg Raw	Chl Settl.
7/10/95	42			43					<0 1			<0.1	0.11			0.35	15	
8/7/95	39			45					<0.1			<0.1	<0.1			0 26	12	
9/11/95	61			56					<0.1			<0 1	<0.1			0.32	18	
10/2/95	63			49					<0.1			<0.1	<0.1			0.45	15	
11/6/95	50			42					<0 1			<0.1	<0.1			0.33	17	
12/4/95	57			55					<0.1			<0.1	0.15			0.44	19	
1/8/96	73			75					<0.1			<0.1	<0 1			0 46	26	
2/5/96	99			90					0 12			0.11	<0.1			0.51	42	
3/4/96	190			181					0.31			0.16	<0.1			0.41	92	
4/1/96	129			131					<0.1			0.13	<0 1			0.40	70	
5/6/96	110			115					0 22			0.19	0.15				60	
6/3/96	67			65					0.12			<0 1	<0.1			0.45	25	

Note: Form is set up for conventional filtration and intermediate ozone.
CCWD's Randall-Bold WTP has pre & post ozone and direct filtration.
Raw = Pre-oz
Filt = Post-oz
Settl. = Applied
N/A - not applicable [chlorination is only done after post-ozone process (after filtration)]

C-031041

C-031041

Utility ID:

1. Study

2. Source

3. Source

WATER

Date	ride (I-/L)		TDS (mg/L)				Turbidity (NTU)				pH ()				Temperature (deg. C)				Bromate (µg/L)				Coliforms Total (#/100mL)				Coliforms Fecal (#/100mL)				Gi (cyst	
	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.
7/10/95		12	80			110	9.68	8.78		0.032	7.45	6.74		6.56	24.1			23.9				21	190			0	7					
8/7/95		12	70			110	10.87	3.14		0.022	7.43	7.21		6.48	25.2			25.0				7.8	65			0	9				0	
9/11/95		14	110			90	4.59	2.19		0.025	7.57	7.14		6.81	23.7			23.0				<5	77			0	8					
10/2/95		17	100			120	3.60	2.40		0.027	7.55	7.25		7.03	22.7			22.0				<5	41			0	5					
11/6/95		21	90			120	2.52	4.46		0.015	7.73	7.21		7.31	18.0			17.0				<5	46			0	2					
12/4/95		21	100			130	2.67	2.79		0.022	7.82	7.46		7.36	16.5			15.2				<5	65			0	8					
1/8/96		33	140			180	5.20	6.20		0.026	7.52	7.05		6.81	13.0			12.0				<5	61			0	1				0	
2/5/96		61	200			300	6.25	17.25		0.020	7.6	7.12		7.04	14.0			12.8				<5	22			0	3				<16	
3/4/96		110	390			390	4.06	6.23		0.062	7.88	7.14		7.01	14.0			13.0				<5	40			0	0					
4/1/96			280			330	3.83	3.08		0.019	8.03	7.24		7.36	16.8			16.0				<5	36			0	4				0	
5/6/96		62	250			290	9.25	10.30		0.018	7.83	6.81		6.71	21.0			21.0				<5	42			0	16				0	
6/3/96		73	120			140	9.55	5.74		0.020	7.59	7.09		7.18	23.5			23.5				<5	28			0	0					

C-031042

C-031042

Utility ID:

1. Study

2. Source

3. Source

WATER

Date	Microbial Parameters dia (/100L)		Crypto. (oocysts/100L)				Viruses (#/mL)				HPC (CFU/mL)				Chlorination conditions, Filtered: Indicate disinfectant(s) used with an 'X'		Chlorine dose	Ammonia dose	Incububation time (h)		Incub. temp.	pH	Residual	TTHM (µg/L)			
	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	chlorine	chloramine	(mg Cl2/L)	(mg NH3-N/L)	chlorine	chloramine	(deg. C)	( )	(mg Cl2/L)	Raw	Settl.	Ozon.	Filt.
7/10/95		0				0					2100			1		X				3.07	22	8.07	1.00				0.9
8/7/95			0								880			4		X				3.97	23.2	9.00	0.97				<0.5
9/11/95											290			3		X	1.66	0.55		21.7	25	9.08	1.04				<0.5
10/2/95											510			0		X	1.79	0.60		27.1	23.8	8.41	1.06				<0.5
11/6/95											1350			0		X	1.71	0.56		20.3	17	9.05	0.96				<0.5
12/4/95		0				0					810			1		X	1.76	0.58		27.1	15.8	9.34	1.23				<0.5
1/8/96		0	0			0					520			2		X	1.82	0.68		32.5	12.5	8.89	1.10				<0.5
2/5/96			<1.6								880			0		X	1.92	0.67		32.5	12.2	8.92	1.04				<0.5
3/4/96											290			6		X	1.99	0.65		46.5	12.5	8.54	1.08				<0.5
4/1/96		0	0			0					510			1		X	1.77	0.64		20.3	15.6	8.68	1.06				<0.5
5/6/96		0	0			0					430			0		X	1.39	0.47		8.13	20.5	8.56	1.12				<0.5
6/3/96											2950			2		X	1.48	0.49		7.4	22.2	8.76	1.19				<0.5

C-031043

C-031043

Utility ID:

1. Study

2. Source

3. Source

Indicate coagulants studied:

ID	Coagulant	Chemical formula	Units
1	Alum		
2	Cat Poly		
3	Non-Ionic		
4			

WATER

TREATMENT CONDITIONS

Post-Ozone

Pre/Post	Stages 1/2/3	Per Stage

Date	Disinfection By-products HAA5 (µg/L) Raw	HAA5 Settl.	HAA5 Ozon.	HAA5 Filt.	HAA6 (µg/L) Raw	HAA6 Settl.	HAA6 Ozon.	HAA6 Filt.	TOX (µg Cl-/L) Raw	TOX Settl.	TOX Ozon.	TOX Filt.
7/10/95								<2				
8/7/95								<1				
9/11/95								5				
10/2/95								<1				
11/6/95								<1				
12/4/95								<1				
1/8/96								2				
2/5/96								<2				
3/4/96								<2				
4/1/96								15.6				
5/6/96								2.5				
6/3/96								<2				

Date	Coagulation Conditions: Coagulant ID (see above)	Dose	Acid adjusted? (Y/N)	Base adjusted? (Y/N)	Coag. pH ()	Coag. temp. (deg. C)	Ozonation Conditions: Ozone dose (mg/L)	Ozone residual (mg/L)	Contact time (min)	Ozone pH ()	Ozone temp. (deg. C)
7/10/95	1/2/3		N	N	6 74	24.1		.36/.23/.3	1.41	7 31	16 2
8/7/95	1/2/3	35 / 1.0 / 0.1	N	N	7.21	25.2	2 5 / 0.5	.34/.27/.3	1.83	6.56	23.9
9/11/95	1/2/3	35 / 1.0 / 0 0	N	N	7 14	23.7	1.81 / 0.3	.06/.05/.0	9.98	6.48	25 0
10/2/95	1/2/3	5.7/ 1.2 / 0.0	N	N	7.25	22.7	1.8 / 0 29	.07/.03/.0	12.48	6.81	23.0
11/6/95	1/2/3	9.5/ 1 03 /0 0	N	N	7 21	18 0	1.55 / 0.3	.16/.09/.0	9.36	7.03	21.5
12/4/95	1/2/3	9 9/1.05/0 0	N	N	7 46	16 5	1 9 / 0.4	.14/.10/.0	12.48	7.36	15.2
1/8/96	1/2/3	44.7/1.0/0 2	N	N	7.05	13.0	2.85 / 0.3	.12/.04/.0	14 98	6.81	12.0
2/5/96	1/2/3	49 8/1.0/0.2	N	N	7.12	14 0	3.12 / 0.4	.26/.16/.1	14.98	7.04	12.8
3/4/96	1/2/3	77.9/3.0/0.49	N	N	7.14	14 0	3.25 / 1.1	.19/.06/.0	21.39	7.01	13.0
4/1/96	1/2/3	5 5/0.93/0.1	N	N	7.24	16 8	2.9 / 0.54	.23/.14/.1	9.36	7.36	16.0
5/6/96	1/2/3	40 / 0 50 /0.0	N	N	6 81	21.0	2.40 / 0.4	.36/.24/.2	3.74	6.71	21 0
6/3/96	1/2/3	27 / 0.48/0.0	N	N	7.09	23 5	1.53 / 0.4	.26/.13/.1	3.40	7.18	23.5

C-031044

Utility ID:			CCWD Randall-Bold WTP	(ACWD, CCWD, EBMUD, MWD, SCVWD)
1. Study ID:			Historical data 7/1/95-8/30/96	(Optimization Study 8/95, etc.)
2. Source water:			Delta (Rock Slough)	(River, lake, groundwater, etc.)
3. Source water ID:			Central Valley Project Water	(State Project water, blend of..., etc.)
		4. Describe level of study:		Bench-scale
		(Indicate with an 'X')		Pilot-scale
			X	Full-scale (see footnotes)

WATER QUALITY DATA: CONVENTIONAL+OZONE

Date	Time	TOC (mg/L)	Alkalinity (mg/L as CaCO3)				Hardness (mg/L as CaCO3) Total				Bromide (mg/L)				Ammonia (mg NH3-N/L)				Chloride (mg Cl/L)				TDS (mg/L)				Turbidity (NTU)				pH ()				Temperature (deg. C)				Bromate (µg/L)				
		Raw	Raw	Settl.	Ozon.	Fil.	Raw	Settl.	Ozon.	Fil.	Raw	Settl.	Ozon.	Fil.	Raw	Settl.	Ozon.	Fil.	Raw	Settl.	Ozon.	Fil.	Raw	Settl.	Ozon.	Fil.	Raw	Settl.	Ozon.	Fil.	Raw	Settl.	Ozon.	Fil.	Raw	Settl.	Ozon.	Fil.	Raw	Settl.	Ozon.	Fil.	Raw
2/23/93			76				127			105	0.22				0.024			0.342	72								17.5	27.5		0.03	7.5	7.3		6.8	12.9							<5	
4/6/93			96				177			180	0.27				0			0.232	89								5.7	12.2		0.088	8.1	7.4		7	17.3							<1.4	
5/21/93			75				104			100	0.17				0.024			0.232	55								12	25.5		0.05	8.8	7.4		6.9	20.2							10	
6/15/93			55				86			55	<0.1				0.024			0.378	30								15.9	16.12		0.044	7.5	7.4		6.75	23.5							6	
8/18/93			50				51			51	<0.1				0.024			0.402	25								4.5	11.5		0.02	8.55	7.36		6.96	25.4							6	
10/5/93			83				85			72	0.18				0.02			0.4	80								4.57	7.75		0.098	9.1	7.19		6.83	23.4							10.3	
11/17/93			58				103			101	0.43				0			0.45	142								1.31	4.52		0.036	7.83	6.86		6.85	17.7							30.4	
12/8/93			58				89			89					0.012			0.293									1.36	2.7		0.046	7			7.3	12.9			14.3				6.9	
1/4/94			80				81			84	0.21				0.085			0.476	70								2.7	5		0.057	7.2			6.7	11.7			11.6				1.5	
2/9/94			68				96			89	0.21				0.012			0.439	70								1.7	5		0.053	7			6.3	12.4			12.2				4.6	
3/1/94			75				105			103	0.17				0			0.427	55								3.8	10.17		0.083	7	6.6		6.8	14.1			13.6				2.8	
4/5/94			86				135			131	0.23				0			-	77								2.8	11.4		0.071	7.87	7		6.8	17.8			17.6				7.3	
5/10/94			81				115			105	0.17				-			-	57								1.48	4.15		0.048	7.6	7.14		6.7	20.1			20.7				<3	
7/12/94			72				109			105	0.34				0.024			0.41	112								5.98	14		0.037	7.7	6.98		6.89	25.7			26.1				<5	
8/9/94			59				99			96	0.4				0.012			0.33	133								3	1.97		0.085	7.54	7.3		6.7	26			26.8				<5	
10/4/94			74				124			122	0.48				0.024			0.38	158								6.1	8.3		0.08	7.6	7.3		6.9	22.7			23.3				51	
10/10/94			75				104			106	0.36				0.012			0.451	118								4.6	4.3		0.052	7.8	7.3		6.9	22.4			22.7				33	
11/1/94			72				107			108	0.45				0.01			0.34	150								2.13	2.43		0.051	8.12	7.17		6.96	20.1			19.9				15	
12/6/94			77				125			134	0.49				0.01			0.44	162								2.38	3.01		0.031	7.8	7.4		7.2	13.4			13.4				13	
1/10/95			86				105			102	0.28				0.024			0.378	94								4.7	19		0.038	7.68	7.1		7	12			12				5.7	
2/14/95			70				118			136	0.18				-			-	60								10.1	22.1		0.028	7.35	6.78		6.68	12.5			12.8				17	
3/14/95			64				103			104	0.11				0.012			0.573	35								8.52	23.5		0.024	7.75	6.93		6.93	14			14.2				7.6	
4/4/95			103				170			185	0.32				-			-	105								7.23	2.95		0.031	7.88	6.94		6.85	16.3			16.9				18	
6/13/95			40				52			48	0.12				-			-	40								26	-		0.1	7.56			6.59	24.8			22.3				<5	
7/10/95		5.7	37			21	42			43	0.1			<0.1	0.11			0.35	32			12	80			110	9.68	8.78		0.032	7.45	6.74		6.58	24.1			23.9				21	190
8/7/95		3.6	38			20	39			45	0.1			<0.1	<0.1			0.26	32			12	70			110	10.87	3.14		0.022	7.43	7.21		6.48	25.2			25.0				7.8	65
9/11/95		7.7	55			46	61			56	<0.1			<0.1	<0.1			0.32	16			14	110			90	4.59	2.19		0.025	7.57	7.14		6.81	23.7			23.0				<5	77
10/2/95		3	58			49	63			49	<0.1			<0.1	<0.1			0.45	14			17	100			120	3.80	2.40		0.027	7.55	7.25		7.03	22.7			22.0				<5	41
11/6/95		2.8	52			43	50			42	<0.1			<0.1	<0.1			0.33	18			21	90			120	2.52	4.46		0.015	7.73	7.21		7.31	18.0			17.0				<5	46
12/4/95		3	55			35	57			55	<0.1			<0.1	0.15			0.44	23			21	100			130	2.67	2.79		0.022	7.82	7.46		7.36	16.5			15.2				<5	65
1/8/96		5.5	62			40	73			75	<0.1			<0.1	<0.1			0.46	26			33	140			180	5.20	6.20		0.028	7.52	7.05		6.81	13.0			12.0				<5	61
2/5/96		6.9	71			36	99			90	0.12			0.11	<0.1			0.51	42			61	200			300	8.25	17.25		0.020	7.8	7.12		7.04	14.0			12.8				<5	22
3/4/96		5.1	107			87	190			181	0.31			0.18	<0.1			0.41	92			110	390			390	4.06	6.23		0.082	7.88	7.14		7.01	14.0			13.0				<5	40
4/1/96		7.8	83			63	129			131	<0.1			0.13	<0.1			0.40	70				280			330	3.83	3.08		0.019	8.03	7.24		7.38	16.8			16.0				<5	36
5/6/96			69			51	110			115	0.22			0.19	0.15				60			62	250			290	9.25	10.30		0.018	7.83	6.81		6.71	21.0			21.0				<5	42
8/5/96		4.1	47			35	67			85	0.12			<0.1	<0.1			0.45	25			73	120			140	9.55	5.74		0.020	7.59	7.09		7.18	23.5			23.5				<5	28

Note: Form is set up for conventional filtration and intermediate ozone

- CCWD's Randall-Bold WTP has pre & post ozone and direct filtration
- Raw = Pre-oz
- Fil = Post-oz
- Settl. = Applied
- N/A - not applicable (chlorination is only done after post-ozone process (after filtration))
- At times, the plant has been operated in start-stop manner resulting in higher ozone doses (and bromate) than would have occurred if the plant were operated in a continuous manner (these periods are not marked but could be made available)

C—031045

C-031045

Utility ID

1. Study

2. Sourc

3. Sourc

WATE

Microbial Parameters

Date	Coliforms Total (#/100mL) Settl.	Coliforms Total (#/100mL) Ozon.	Coliforms Total (#/100mL) Fltr.	Coliforms Fecal (#/100mL) Raw	Coliforms Fecal (#/100mL) Settl.	Coliforms Fecal (#/100mL) Ozon.	Coliforms Fecal (#/100mL) Fltr.	Giardia (cysts/100L) Raw	Giardia (cysts/100L) Settl.	Giardia (cysts/100L) Ozon.	Giardia (cysts/100L) Fltr.	Crypto. (oocysts/100L) Raw	Crypto. (oocysts/100L) Settl.	Crypto. (oocysts/100L) Ozon.	Crypto. (oocysts/100L) Fltr.	Viruses (#/mL) Raw	Viruses (#/mL) Settl.	Viruses (#/mL) Ozon.	Viruses (#/mL) Fltr.	HPC (CFU/mL) Raw	HPC (CFU/mL) Settl.	HPC (CFU/mL) Ozon.	HPC (CFU/mL) Fltr.
2/23/93																							
4/6/93																							
5/21/93																							
6/15/93																							
8/18/93																							
10/5/93																							
11/17/93																							
12/8/93																							
1/4/94																							
2/9/94																							
3/1/94																							
4/5/94																							
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12/6/94																							
1/10/95																							
2/14/95																							
3/14/95																							
4/4/95																							
6/13/95																							
7/10/95			0	7							0				0					2100			1
8/7/95			0	9				0				0								880			4
9/11/95			0	8																290			3
10/2/95			0	5																510			0
11/6/95			0	2																1350			0
12/4/95			0	6							0				0					810			1
1/8/96			0	1				0			0	0			0					520			2
2/5/96			0	3				<1.6				<1.6								880			0
3/4/96			0	0																290			6
4/1/96			0	4				0			0	0			0					510			1
5/6/96			0	16				0			0	0			0					430			0
6/3/96			0	0																2950			2

Chlorination conditions (Filtered) and TTHM

Date	Indicate disinfectant(s) used with an 'X': chlorine	Indicate disinfectant(s) used with an 'X': chloramine	Chlorine dose (mg Cl2/L)	Ammonia dose (mg NH3-N/L)	Incubation time (h) chlorine	Incubation time (h) chloramine	Incub. temp. (deg. C)	pH ()	Residual (mg Cl2/L)	TTHM (µg/L) Raw	TTHM (µg/L) Settl.	TTHM (µg/L) Ozon.
2/23/93		X	1.3	0.43		8.1	12.7	8.5	0.84			
4/6/93		X	1.3	0.43		4.5	16.8	8.8	0.77			
5/21/93		X	1.3	0.43		5.3	20.1	8.4	1.35			
6/15/93		X	1.1	0.37		3.7	22.9	8	1.17			
8/18/93		X	1.6	0.53		13.3	25.2	8.90	1.31			
10/5/93		X	1.3	0.433		4.1	23	8.81	1.19			
11/17/93		X	1.3	0.433		5.3	15.9	8.84	1.12			
12/8/93		X	1.3	0.5		27.1	13	8.8	1.18			
1/4/94		X	1.5	0.48		29.1	11.1	8.9	1.14			
2/9/94		X	1.5	0.53		28.1	11.8	8.9	1.1			
3/1/94		X	1.6	0.53		31.3	13.1	8.8	1.08			
4/5/94		X	1.5	0.51		16.3	17.4	8.7	1.13			
5/10/94		X	1.2	0.38		8.0	18.9	8.88	1.08			
7/12/94		X	1.5	0.5		24.7	25.7	8.68	1.29			
8/9/94		X	1.8	0.6		18.7	26.1	8.57	1.05			
10/4/94		X	1.35	0.45		5.1	23	8.5	1.19			
10/10/94		X	1.35	0.45		5.1	22.2	8.7	1.15			
11/1/94		X	1.35	0.45		5.1	19.3	8.78	1.03			
12/6/94		X	1.4	0.47		13.6	13.4	8.8	1.16			
1/10/95		X	1.4	0.47		27.1	11.1	8.8	1.19			
2/14/95		X	1.5	0.52		20.3	12	8.82	1.34			
3/14/95		X	1.6	0.52		36.2	13.3	8.74	1.06			
4/4/95		X	1.8	0.57		18.3	15.1	9.36	0.98			
6/13/95		X	1.6	0.47		4.3	21.2	8.86	1.25			
7/10/95		X				3.07	22	9.07	1.00			
8/7/95		X				3.87	23.2	9.00	0.97			
9/11/95		X	1.86	0.55		21.7	25	9.08	1.04			
10/2/95		X	1.79	0.80		27.1	23.8	9.41	1.05			
11/6/95		X	1.71	0.58		20.3	17	9.05	0.98			
12/4/95		X	1.76	0.58		27.1	15.8	8.34	1.23			
1/8/96		X	1.82	0.68		32.5	12.5	8.88	1.10			
2/5/96		X	1.92	0.67		32.5	12.2	8.92	1.04			
3/4/96		X	1.99	0.65		46.5	12.5	8.54	1.08			
4/1/96		X	1.77	0.84		20.3	15.6	8.86	1.08			
5/6/96		X	1.39	0.47		8.13	20.5	8.56	1.12			
6/3/96		X	1.48	0.48		7.4	22.2	8.76	1.19			

Note.

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C-031046

C-031046

Utility ID	
1. Study	
2. Sourc	
3. Sourc	

Indicate coagulants studied:

ID	Coagulant	Chemical formul	Units
1	Alum		
2	Cat Poly		
3	Non-Ionic		
4			

WATE

TREATMENT CONDITIONS

Pre/Post | 1/2/3 | Stage | Post-Ozone Stages | Per

Date	Disinfection By-products Fnl.	HAA9 (µg/L) Raw	HAA9 Settl.	HAA9 Ozon.	HAA9 Fnl.	TOX (µg Cl-/L) Raw	TOX Settl.	TOX Ozon.	TOX Fnl.	Coagulation Conditions: Coagulant ID (see above)	Dose 1	Dose 2	Dose 3	Acid dilute (Y/N)	Base adjusted (Y/N)	Coag. pH ()	Coag. temp. (deg. C)	Ozonation Conditions: Ozone dose (mg/L) Pre	Ozone dose Post	Ozone residual (mg/L) 1	Ozone residual 2	Ozone residual 3	Contact time (min)	Ozone pH ()	Ozone temp. (deg. C)	Post-Ozone Stages	Per
2/23/93										1/2/3	55	3	0.1	N	N	7.3	12.9	0.00	0.70	0.3	0.29	0.29	2.79	6.6			
4/6/93										1/2/3	37		0.14	N	N	7.4	17.3	2.00	1.00	0.51	0.28	0.28	2.05	7			
5/21/93										1/2/3	45	4		N	N	7.4	20.2	2.75	1.10	0.26	0.2	0.2	2.42	6.9			
6/15/93										1/2/3	24		0.12	N	N	7.4	23.5	2.00	0.90	0.29	0.18	0.18	1.69	6.75			
8/18/93										1/2/3	37	2	0.2	N	N	7.38	25.4			0.58	0.15	0.15	6.14	6.98			
10/5/93										1/2/3	26		0.2	N	N	7.19	23.4	1.75	0.80	0.35	0.1	0.1	1.88	6.83			
11/17/93										1/2/3	24		0.2	N	N	6.66	17.7	1.50	0.45		0.46	0.45	2.42	6.85			
12/8/93										1/2/3	20		0.83	N	N		12.9	1.50	0.40		0.28	0.14	12.46	7.3	14.3		
1/4/94										1/2/3	23.5		0.2	N	N		11.7	1.50	0.35		0.16	0.19	13.37	6.7	11.6		
2/9/94										1/2/3	30	2		N	N		12.4	1.50	0.35	0.13	0.05	0.03	12.91	6.3	12.2		
3/1/94										1/2/3	30	2.1	0.073	N	N	6.6	14.1	2.50	0.45	0.18	0.09	0.04	14.4	6.6	13.6		
4/5/94										1/2/3	38	1	0.08	N	N	7	17.8	2.50	0.66	0.13	0.09	0.09	7.49	6.9	17.6		
5/10/94										1/2/3	34	0.7	0.09	N	N	7.14	20.1	1.75	0.30	0.35	0.15	0.12	4.18	6.7	20.7		
7/12/94										1/2/3	31	0.8	0.075	N	N	6.98	25.7	3.50	0.35	0.15	0.05	0.04	11.35	6.88	26.1		
8/9/94										1/2/3	23	0.66	0.08	N	N	7.3	28	2.50	0.40	0.12	0.04	0.02	8.61	6.7	26.8		
10/4/94										1/2/3	14	1.7	0.075	N	N	7.3	22.7	2.50	0.40	0.27	0.23	0.15	2.34	6.9	23.3		
10/10/94										1/2/3	14	1.7	0.075	N	N	7.3	22.4	1.70	0.40	0.27	0.28	0.19	2.34	6.8	22.7		
11/1/94										1/2/3	14	1.7	0.075	N	N	7.17	20.1	1.50	0.40	0.1	0.15	0.16	2.34	6.96	19.9		
12/6/94										1/2/3	18	1	0.075	N	N	7.4	13.4	2.00	0.40	0.33	0.21	0.14	6.24	7.2	13.4		
1/10/95										1/2/3	30	1	0.1	N	N	7.1	12	2.00	0.43	0.22	0.06	0.06	12.48	7	12		
2/14/95										1/2/3	71	3.35	0.25	N	N	6.78	12.5	3.00	0.65	0.1	0.07	0.06	8.36	6.66	12.8		
3/14/95										1/2/3	40	1.13	0.11	N	N	6.93	14	2.00	0.40	0.16	0.1	0.07	16.64	6.93	14.2		
4/4/95										1/2/3	87	1	0.11	N	N	6.94	16.3	2.50	0.80	0.27	0.09	0.09	7.48	5.85	16.9		
6/13/95										1/2/3	30	1	0.1	N	N		24.6	2.50	0.80	0.32	0.12	0.24	1.97	6.59	22.2		
7/10/95	0.9				<2					1/2/3				N	N	6.74	24.1			0.38	0.23	0.37	1.41	7.31	16.2		
8/7/95	<0.5				<1					1/2/3	35	1	.1	N	N	7.21	25.2	2.50	0.50	0.34	0.27	0.3	1.83	6.56	23.9		
9/11/95	<0.5				5					1/2/3	35	1	.05	N	N	7.14	23.7	1.81	0.31	0.06	0.05	0.04	9.96	6.48	25.0		
10/2/95	<0.5				<1					1/2/3	15	1.2	.05	N	N	7.25	22.7	1.80	0.29	0.07	0.03	0.02	12.48	6.81	23.0		
11/6/95	<0.5				<1					1/2/3	18.5	1.03	.05	N	N	7.21	18.0	1.55	0.30	0.16	0.09	0.09	9.38	7.03	21.5		
12/4/95	<0.5				<1					1/2/3	19.9	1.05	.05	N	N	7.46	16.5	1.90	0.40	0.14	0.1	0.08	12.48	7.36	15.2		
1/8/96	<0.5				2					1/2/3	44.7	1	.2	N	N	7.05	13.0	2.85	0.38	0.12	0.04	0.03	14.98	6.81	12.0		
2/5/96	<0.5				<2					1/2/3	49.8	1	.2	N	N	7.12	14.0	3.12	0.45	0.28	0.16	0.13	14.98	7.04	12.8		
3/4/96	<0.5				<2					1/2/3	77.9	3	.49	N	N	7.14	14.0	3.25	1.15	0.19	0.06	0.01	21.39	7.01	13.0		
4/1/96	<0.5				15.8					1/2/3	45.5	.93	.19	N	N	7.24	16.8	2.90	0.54	0.23	0.14	0.13	9.36	7.36	16.0		
5/6/96	<0.5				2.5					1/2/3	40	0.5	0.02	N	N	6.81	21.0	2.40	0.43	0.36	0.24	0.26	3.74	6.71	21.0		
6/3/96	<0.5				<2					1/2/3	27	.48	.01	N	N	7.09	23.5	1.53	0.43	0.26	0.13	0.16	3.40	7.18	23.5		

Note
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C-031047

Utility ID:	EBMUD	(ACWD, CCWD, EBMUD, MWD, SCVWD)
1. Study ID:	EBMUD Alternate Source Study	(Optimization Study 9/95, etc.)
2. Source water:	(American) River	(River, lake, groundwater, etc.)
3. Source water ID:		(State Project water, etc.)

5. Describe point of reference for which water quality data are being supplied, i.e. upstream and downstream of City of Sacramento combined sewage discharge, etc.

Nimbus Dam, American River

If entering data on seasonal changes in plant raw source water quality, use upstream column.

WATER QUALITY DATA: RAW

Date	Time	TOC (mg/L) Upstr.	TOC (mg/L) Down.	Alkalinity (mg/L as CaCO) Upstr.	Alkalinity (mg/L as CaCO) Down.	Hardness (mg/L as CaCO3) Total Upstr.	Hardness (mg/L as CaCO3) Total Down.	Bromide (µg/L) Upstr.	Bromide (µg/L) Down.	Ammonia (mg NH3-N/L) Upstr.	Ammonia (mg NH3-N/L) Down.	Chloride (mg Cl-/L) Upstr.	Chloride (mg Cl-/L) Down	TDS (mg/L) Upstr.	TDS (mg/L) Down.	Turbidity (NTU) Upstr.	Turbidity (NTU) Down.	pH () Upstr.	pH () Down.	Temperature (deg. C) Upstr.	Temperature (deg. C) Down.	Microbial Parameters Coliforms Total (#/100mL) Upstr.	Microbial Parameters Coliforms Total (#/100mL) Down.	Microbial Parameters Coliforms Fecal (#/100mL) Upstr.	Microbial Parameters Coliforms Fecal (#/100mL) Down
1/17/89		2.4		32		33		<0.005		0.009		4		59		1.8		7.7		8		26		11	
2/14/89		1.6		31		32		<0.03		0.01		5		60		0.98		7.8		8		50		11	
3/13/89		2.8		33		35		<0.02		0.01		4		64		3.5		7.8		11		430		140	
4/17/89		1.8		27		28		<0.05		0.016		3		53		2.3		8.1		15		800		500	
5/15/89		1.9		24		25		<0.05		<0.005		3		50		1.5		7.8		18		210		30	
6/19/89		1.9		24		22		<0.05		0.04		2		45		1.1		7.6		18		170		30	
6/19/89		2.3		25		120						13		47		1.2						170		80	
6/19/89				120																		500		130	
7/17/89		1.4		21		22		<0.03		<0.005		2		46		0.7		7.5		24		1300		300	
8/14/89		35		24		21		<0.05		0.005		6		44		0.82		7.4		24.5		300		80	
9/25/89		1.4		21		20		<0.01				4		44		0.45		7.5		20		220		130	
11/13/89		1.7		21		21		0.01		<0.005		2		44		1.1		7.4		16		80		80	
12/11/89		1.3		29		24		<0.01		0.01		2		47		2.5		7.4		11		1100		800	
12/11/89																						2200		2200	
1/22/90		1.3		23		24		<0.01		<0.005		2		49		1.3		7.6		9		110		110	
2/20/90		1.8		25		26		<0.02		0.007		4		50		5.5		7.7		8		800		300	
3/5/90		1.3		36		32		0.01				5		57		1.6		7.8		11.5		17		4	
4/9/90		1.2		31		29		<0.01		<0.005		4		53		0.57		7.8		17.5		80		50	
5/21/90		1.4						0.01				3		54		0.64						280			
6/25/90		1.3		27		27		<0.05		0.03		3		51		0.38		7.5		17.5		80		80	
7/16/90		1.3						<0.01				4		48		0.5						11			
8/20/90		1.4						0.02				2		43		2.5									
9/17/90		1.4						0.01				2		39		0.95						80			
10/15/90		1.5		21		18		0.11				2		40		0.77		7.4		20		50		30	
10/15/90		1.6		22		20		<0.01								0.8						170		70	
11/26/90		1.5						<0.01				4		43		0.94						500			
12/17/90		1.5						<0.01				4		47		3.1						70			
1/7/91		1.2		25		21		<0.01				3		34		1.3		7.6				50		50	
1/7/91		1.3		27								4				1.6						110		110	
2/11/91		1.7		30		25		0.02				6		50		4.1		7.2		13		130		50	
3/11/91		2.3		27		32		0.01		0.01		4		58		3.4		7.6		12		1700		500	
3/11/91										0.08															
4/8/91		3.2		36		39		0.01		0.01		4		68				8.6		16		50		23	
5/20/91		1.9		32		32		0.01		<0.02		2		59		1.6		8.2		19.5		800		500	
6/17/91		1.9		26		26		<0.01				3		51		1.8		7.6		21.5		70		11	
6/17/91																								23	
7/8/91		1.3		28		25		<0.01				2		50		1.2		7.8		20.5		90		30	
7/8/91		1.7		32		31						3		51		1.5		8.4				500		80	
7/8/91												13				1.8									
8/19/91		1.5		27		23		<0.01				2		46		1.1		7.8		23.5		50		17	
8/19/91		1.6		28		24						3		49								60		23	
9/16/91				24		22		<0.01				4		55		0.6		7.6		24		350		30	
9/16/91												14													
10/15/91		1.6		25		21		0.07		0.02		3		45		1.1		7.4		20.5		110		80	
10/15/91								<0.01																	
11/18/91		1.4		27		25		0.02		0.01		3		48		1.2		7.6		15		130		23	
11/18/91								0.1																	
12/16/91		1.7		26		23		<0.05				2		44		0.79		7.6		11		70		70	

C-031048

C-031048

Utility ID: ACWD (ACWD, CCWD, EBMUD, MWD, SCVWD)

1. Study ID: (Optimization Study 9/95, etc.)

2. Source water: (River, lake, groundwater, etc.)

3. Source water ID: (State Project water, blend of....., etc.)

5. Describe level of study: (indicate with an 'X') Bench-scale / Pilot-scale / Full-scale

In this data sheet, "Filt." refers to data collected after coagulation, flocculation, sedimentation, and filtration.

6. Indicate with an 'X' if data reported as "Filt." are from samples collected after sedimentation only:
or after sedimentation and filtration:

WATER QUALITY DATA: CONVENTIONAL

Date	Time	TOC (mg/L)		UV-254 (1/cm)		Bromide (µg/L)		Turbidity (NTU)		Temperature (deg. C)		Disinfection By-products: TTHM (µg/L)		HAA5 (µg/L)		HAA6 (µg/L)	
		Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.
5/30/95		4.3	2.7					16.2		66.4							
6/6/95		4.3	2.0			40.0		29.0		65.9			28.9				
6/13/95		3.6	1.8			42.0		14.1		67.3			40.2				
6/20/95		3.5	1.9			60.0		15.6		66.3			44.0		48.0		
6/27/95		3.8	2.0			80.0		13.4		76.7			49.6				
7/4/95		4.2	2.3					17.4		73.3			45.2				
7/11/95		4.1	2.1			68.0		23.0		72.3			43.0				
7/18/95		3.8	1.9			50.0		19.5		73.5			45.9				
7/25/95			2.4			72.0		21.2		72.6			48.0				
8/1/95		4.1	2.2			65.0		13.3		78.3			48.0				
8/8/95		3.6	1.9			60.0		11.5		76.2			49.8				
8/15/95		3.1	2.0			60.0		11.4		77.0			58.9				
8/22/95		3.2	2.2			55.0		10.6		75.6			58.9				
8/29/95						50.0		11.5		71.2							
9/5/95		3.4	2.0			81.0	<20	12.5		70.5			61.1		37.0		44.0
9/12/95		4.1	3.3			42.0	12.0	2.3		68.9			86.9				
9/19/95		4.0	3.2			50.0	<20	2.2		68.4			85.9		58.0		65.0
9/26/95		4.0	2.8			53.0	10.0	8.3		67.9							
10/3/95		4.1	2.8			49.0	17.0	5.0		64.1			55.4		43.0		49.0
10/10/95		4.3	3.0			44.0	<40	4.4		62.6			72.0				
10/17/95		4.2				43.0		6.6		63.0							
10/24/95		3.9	2.8			47.0	14.0	4.3		61.9							
10/31/95		3.8	2.5			45.0	12.0	6.5		61.7			58.6		35.0		40.0
11/7/95		3.8	2.6	0.19	0.07	47.0	13.0	5.3		59.9			72.1				
11/14/95		4.3	3.1	0.18		39.0	12.0								46.0		52.0
11/21/95		3.4	3.3	0.19	0.10	42.0	16.0										
11/28/95				0.14	0.10	86.0	16.0						55.5		23.0		28.0
12/5/95		4.4	3.4	0.13	0.09			1.6		58.5			73.1				
12/12/95		4.6	4.0	0.12	0.08	39.0	<20	2.2		58.0					56.0		62.0
12/19/95		4.7	3.7	0.14	0.10	38.0	<20	3.9		55.8			73.3				
12/26/95		3.1	2.0	0.12	0.09	97.0	24.0	7.6		52.5					31.0		38.0
1/2/96		3.3	2.1	0.13	0.09	150	36.0	3.6		53.8			64.6				
1/9/96		6.4	3.7	0.24	0.10	110	31.0	4.8		52.7			75.2		54.0		63.0
1/16/96		6.4	3.5	0.27	0.11	87	24.0	4.0		51.4			80.0				
1/23/96		3.0	2.4	0.18	0.16			9.3		50.7							
1/30/96		3.5	3.2	0.20	0.10			20.0		51.4			77.8				
2/6/96		5.6	3.6	0.20	0.11								75.0				
2/13/96		5.6	3.6	0.17	0.08								76.1				
2/20/96		5.8	3.6	0.13	0.31								88.0				
2/27/96		5.8	3.0	0.20	0.11								72.8				
3/5/96		0.0	3.1	0.22	0.09		14.0						80.7		54.0		57.0
3/12/96		5.6	3.1	0.21	0.10		<20										
3/19/96		5.5	3.4	0.22	0.10		<20						61.3		49.0		52.0
3/26/96		5.3	3.1	0.21	0.09		14.0						81.3				
4/2/96				0.20	0.09								57.2		31.0		38.0
4/9/96				0.21	0.08								94.7				
4/16/96		4.4	3.0	0.20	0.10		<10.0								59.0		68.0
4/23/96		4.2	2.8	0.21	0.09		29.0						71.4				
4/30/96			2.4		0.09		34.0						76.7		41.0		52.0
5/7/96		3.7	2.6	0.20	0.09		41.0						73.3				
5/14/96		3.6	2.8	0.21	0.09		45.0						85.0		43.0		55.0
5/21/96					0.09												
5/28/96		3.8	2.1	0.22			20.4						52.3		34.0		41.0
6/4/96		3.6	2.3	0.22	0.08		24.6						70.4				
6/11/96			1.9		0.08		17.2						80.1		38.0		43.0
6/18/96			1.8	0.19	0.08		10.6						53.9				
6/25/96			1.9		0.08		25.2						43.9				
7/2/96		3.2	2.0				20.4						64.8				
7/9/96							13.7										

C-031049

C-031049

preozone

Utility ID:	ACWD	(ACWD, CCWD, EBMUD, MWD, SCVWD)
1. Study ID:	Routine Monitoring	(Optimization Study 9/95, etc.)
2. Source water:	River	(River, lake, groundwater, etc.)
3. Source water ID:	South Bay Aqueduct	(State Project water, blend of ..., etc.)

4. If blended source water indicate sources and proportions:

Source	%

5. Describe level of study: (indicate with an 'X')

	Level	
	Bench-scale	In this data sheet, "Filt." refers to data collected
	Pilot-scale	after coagulation, flocculation, sedimentation, and
X	Full-scale	filtration.

6. Indicate with an 'X' if data reported as "Filt." are from samples collected after sedimentation only:
or after sedimentation and filtration:

WATER QUALITY DATA: PRE-OZONE

Date	Time	TOC (mg/L)			UV-254 (1/cm)			Alkalinity (mg/L as CaCO3)			Hardness (mg/L as CaCO3) Total			Calcium			Bromide (µg/L)			Chloride (mg Cl-/L)			Turbidity (NTU)		
		Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.
1/3/95		5.8	5.4	3.4				82		84	132									108.0			8.77		0.05
1/10/95		5.6		2.9				74		80	104									70.0			30.00		0.08
1/17/95		5.9	5.7	3.3				139		138	162						100.0			41.0			88.80		0.04
1/24/95		5.9	5.9	3.5				140		162	168						80.0			33.0			50.70		0.05
1/31/95		6.0	6.4	3.5				170		158	154						70.0			25.0			56.00		0.04
2/7/95		5.8	5.6	3.3				152		92	160									26.0			36.50		0.04
2/14/95		5.7	5.4	3.4				158		160	140						71.0			61.0			29.70		0.05
2/21/95		5.8	5.3	3.5				152		166	142						72.0			40.0			24.30		0.05
2/28/95		5.6	5.4	3.7				158		160	144						56.0			42.0			10.80		0.03
3/7/95		5.8	5.4	3.7				122		120	136						83.0			61.0			8.20		0.05
3/14/95		6.1	5.6	3.1				110		126	144						50.0			34.0			17.10		0.05
3/21/95		5.8	5.1	3.2				102		98	120						90.0			45.0			21.20		0.06
3/28/95		6.1	5.3	3.2				128		130	136						40.0			41.0			61.50		0.06
4/4/95			5.4	3.3				94		94	110						170.0			90.0			9.00		0.06
4/11/95		5.9	5.7	3.7				96		112	120						200.0			75.0			17.00		0.04
4/18/95		5.6	5.3	3.2				106		112	126						110.0			41.0			16.80		0.04
4/25/95		5.8	5.7	3.4				90		94	140						120.0			82.0			12.17		0.06
5/2/95		5.3	5.1	3.2				112		106	126						87.0			144.0			10.78		0.03
5/9/95		5.1	5.0	2.8				78		88	108						90.0			47.0			8.68		0.04
5/16/95		4.7	4.3	2.4				70		72	88						60.0			34.0			11.23		0.05
5/23/95		5.0	4.7	2.2				64		72	80						40.0			35.0			23.00		0.04
5/30/95		4.3	3.8	1.9				56		58	82									30.0			15.95		0.06
6/6/95		4.6	4.4	1.8				44		44	62						40.0			24.0			28.67		0.04
6/13/95		3.9	3.4	1.6				44		44	50						42.0			25.0			13.17		0.03
6/20/95		3.7	3.3	1.8				38		46	56						60.0			60.0			14.93		0.06
6/27/95		3.9	3.7	1.8				48		52	66						80.0			58.0			14.10		0.08
7/4/95		4.0	2.7	1.9				42		50	56									40.0			16.47		0.02
7/11/95		3.7	3.2	1.6				44		46	60						68.0			26.0			20.62		0.04
7/18/95		3.6	2.4	1.5				40		44	47						50.0			25.0			17.78		0.04
7/25/95		4.0	3.1	1.9				45		53	56						72.0			19.0			19.32		0.05
8/1/95		4.6	2.6	1.6				49		51	54						65.0			18.0			14.20		0.06
8/8/95				1.5				50		52	48						60.0			26.0			12.73		0.07
8/15/95		3.2	1.3	1.5				48		50	52						60.0			25.0			12.13		0.05
8/22/95		3.1	1.8	1.5				54		59	60						55.0			47.0			10.67		0.06
8/29/95		3.1	2.6	1.4				55		61	54						50.0			23.0			10.62		0.05
9/5/95		3.7	3.6	1.5				59		66	60						61.0	<5	<20	25.0			12.37		0.06
9/12/95		4.4	2.2	2.3				106		132	127						42.0		<40	28.0			1.94		0.05
9/19/95		4.5	2.7	2.1				112		128	114						50.0		<20	31.0			1.68		0.06
9/26/95		4.2	4.2	2.3				96		106	100						53.0		<20	30.0			8.40		0.08
10/3/95		4.1	4.4	2.4				89		94	110						49.0		<40	52.0			4.91		0.07
10/10/95		4.5	3.7	2.6				103		108	104						44.0		<40	38.0			3.86		0.06
10/17/95		4.2	3.1	2.5				102		109	111						43.0		<20	129.0			6.65		0.06
10/24/95		3.9	3.7	2.3				94		104	102						47.0		12.0	18.0			3.77		0.07
10/31/95			2.9	2.1				90		94	98						45.0		<20	21.0			4.36		0.07
11/7/95			2.6	2.2			0.09	88		92	98						47.0		<20	20.0			4.70		0.07
11/14/95		4.2	2.6	2.5			0.07	114		120	130						39.0		10.0	5.0			3.15		0.06
11/21/95		4.4	3.2	2.8			0.07	106		124	124						42.0		<20	12.0			2.63		0.07
11/28/95							0.09	54		58	88						86.0		<20	37.0			8.61		0.06
12/12/95		4.6	4.3	3.3			0.07	156		168	172						39.0		<20	14.0			2.64		0.05
12/19/95		4.6	3.7	3.3			0.07	137		141	160						38.0		<20	13.0			4.22		0.06
12/26/95		3.3	3.3	1.7			0.06	84		90	90						97.0		<20	25.0			5.85		0.06
1/2/96		3.4	4.0	1.9			0.07	66		70	82						150.0		<20	50.0			4.83		0.07
1/9/96		6.4	4.6	2.9			0.07	79		82	104						110.0		47.0	44.0			5.37		0.07
1/16/96		6.2	4.0	2.8			0.13	72		90	140						87.0		<20	50.0			4.48		0.07
1/23/96		5.6	6.6	3.5			0.08	75		89	92									40.0			10.10		0.06
1/30/96		5.8	4.3	2.7			0.07	110		122	130									26.0			21.00		0.06
2/6/96		5.8	3.3	3.4			0.08	147		153	180									21.0			13.70		0.07
2/13/96		5.4	3.8	3.4			0.03	90		92	168									11.0			13.00		0.06
3/12/96		5.5	5.0	3.0			0.09	88		86	134						21.0		<20	10.0			33.20		0.08
3/19/96		5.4	5.2	2.8			0.10	96		100	142						17.0		<20	14.0			17.10		0.07
3/26/96		5.2	4.8	2.6			0.08	88		89	122						41.0		<20	13.0			14.00		0.07
4/2/96		3.3	3.2				0.09	54		59	74						94.0		<20	37.0			18.20		0.05
4/9/96		3.8	3.7	2.2			0.09	58		62	96									54.0			5.90		0.06
4/16/96		4.0	3.7	2.4			0.10	62		66	102						95.0		11.0	30.0			5.70		0.07
4/23/96		4.0	4.1	2.2			0.09	70		76	100						110.0		<10	54.0			7.00		0.06
4/30/96		3.7	3.9	1.9			0.09	50		54	98						120.0		<10.0	60.0			13.60		0.06
5/7/96		3.7	3.7	1.9			0.09	50		52	90						140.0		27.0	60.0			7.30		0.05
5/14/96		3.7	3.8	1.9			0.09	42		51	88						130.0		<20	61.0			7.10		0.06
5/21/96								52		55	102									48.0			5.90		0.07
5/28/96		3.8	3.0	1.7			0.09	68		64	106						79.0		<1	28.0			21.70		0.06
6/4/96		3.5	3.4	1.6			0.08	50		54	76						75.2		<1	16.0			15.80		0.07
6/11/96		3.4	3.3	1.5			0.09	54		68	58						56.0		<3	81.0			19.80		0.07
6/18/96		3.8	3.7	1.6			0.08	58		73	82						59.6		<3	32.0			39.00		0.07
6/25/96		3.2	3.0	1.6				63		74	102						52.7		13.8	13.0			19.70		0.08

C-031050

C-031050

Utility ID:

1. Study ID

2. Source w

3. Source w

5. Describe

(Indicate wi

6. Indicate

WATER QU | TREATMENT CONDITIONS

Date	pH ()			Temperature (deg. C)			Bromate (µg/L)			TTHM (µg/L)			HAA5 (µg/L)			HAA6 (µg/L)			Ozonation Conditions				
	Raw	Ozon.	Filt.	Raw	Ozon	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Ozone dose (mg/L)	Ozone residual (mg/L)	Contact time (min)	Ozone pH ()	Ozone temp. (deg. C)
1/3/95	7.7		7.0	8.6								7.8			9			14	2.2	0.49		8.1	8.8
1/10/95	7.8		6.7	10.8								7.7						6	2.3	0.64		8.2	10.8
1/17/95	8.0		7.0	11.3								4.2			6			5	1.7	0.44		8.0	11.3
1/24/95	8.0		7.0	11.6								4.8						4	1.8	0.40		8.5	11.6
1/31/95	7.9		6.9	11.6								4.4						5	2.0	0.37		8.6	11.6
2/7/95	7.9		6.8	12.3								4.8						5	3.5	0.91		8.3	12.3
2/14/95	8.0		6.9	10.2								5.1			5			6	4.8	0.83		8.4	10.2
2/21/95	7.9		7.1	10.0								4.8						3	3.2	0.68		8.2	10.0
2/28/95	8.4		7.4	11.2								5.1			6			7	3.8	0.49		8.2	11.2
3/7/95	8.1		7.2	12.0														18	3.8	0.66		7.6	12.0
3/14/95	8.1		7.1	11.5								3.6			3			6	3.7	0.74		7.7	11.5
3/21/95	8.2		7.1	12.0					6.0			4.8						4	3.7	0.69		7.3	12.0
3/28/95	8.0		7.0	11.2								3.8			4			3	3.8	0.62		6.9	11.2
4/4/95	8.5		7.0	16.0					12.0			82.8						4	3.9	0.38		7.4	16.0
4/11/95	8.6		7.1	15.3								8.3			6			3	3.5	0.73		7.5	15.3
4/18/95	8.3		7.0	14.1					9.0			4.9						3	4.7	0.59		7.8	14.1
4/25/95	8.4		7.1	15.5					6.0			6.9						2	3.8	0.62		7.4	15.5
5/2/95	8.2		7.2	15.7								5.4							3.5	0.55		7.2	15.7
5/9/95	8.2		6.9	16.1								13.3							4.0	0.60		7.4	16.1
5/16/95	7.6		6.8	16.5								8.4							3.9	0.77		7.5	16.5
5/23/95	7.7		6.6	18.0								5.1							3.6	0.83		7.6	18.0
5/30/95	7.3		6.6	19.3								5.0							4.2	0.52		7.7	19.3
6/6/95	6.9		6.2	19.0								6.1							3.3	0.59		7.4	19.0
6/13/95	7.4		6.5	19.2								5.0							3.6	0.60		7.7	19.2
6/20/95	7.5		6.6	19.1					6.0			4.7			3				3.8	0.69		7.6	19.1
6/27/95	7.8		6.6	24.9					8.0			6.1							3.3	0.81		7.3	24.9
7/4/95	7.4		6.4	22.9					8.0			5.6							4.0	0.47		8.0	22.9
7/11/95	7.2		6.3	22.7								6.3			2				4.2	0.61		8.0	22.7
7/18/95	7.4		6.3	23.2					10.0			4.1							4.1	0.52		7.5	23.2
7/25/95	7.5		6.4	21.6					5.0			4.3			3				4.2	0.42		6.9	21.6
8/1/95	7.6		6.2	25.9					9.0			6.2							2.0	0.30		6.9	25.9
8/8/95	7.7		6.5	24.5					6.0			3.9			3				3.8	0.83		7.6	24.5
8/15/95	7.4		6.1	25.4					7.0			3.8							4.1	0.52		7.4	25.4
8/22/95	7.7		6.3	24.4					10.0						11				2.2	0.28		7.5	24.4
8/29/95	7.6		6.6	22.0					10.0													7.6	22.0
9/5/95	7.3		6.6	21.6				<5	11.0			3.3			10			14	2.2	0.94		7.7	21.6
9/12/95	8.0		6.9	19.4				6.0	15.0			32.8							4.1	1.20		7.6	19.4
9/19/95	8.0		7.0	21.1				21.0	14.0			13.8			4			6	6.5	0.65		8.1	21.1
9/26/95	7.5		6.8	19.9				<5	23.0										3.1	1.00		7.7	19.9
10/3/95	6.9		6.9	17.8				<5	5.0			6.1			4			5	2.7	0.82		7.8	17.8
10/10/95	6.9		6.9	16.8				<5	<5			5.8							2.6	0.76		7.7	16.8
10/17/95	7.6		6.9	17.1				9.0	<5										2.8	0.56		8.1	17.1
10/24/95	7.4		6.9	16.7				<5	<5										3.0	0.77		7.5	16.7
10/31/95	7.5		6.9	15.6				<5	<5			3.7			3			4	2.9	0.67		7.5	15.6
11/7/95	7.6		6.9	15.4				<5	<5			6.2							3.0	0.82		7.6	15.4
11/14/95	7.7		6.8	15.0				<5	<5						4			5	3.0	0.78		7.7	15.0
11/21/95	7.6		6.9	15.0				<5	<5										2.9	0.81		7.8	15.0
11/28/95	8.1		6.7	14.6				14.0	<5			3.0			4			5	3.5	0.66		7.8	14.6
12/12/95	7.7		7.0	14.5				<5							5			6	2.4	0.65		7.9	14.5
12/19/95	7.8		7.2	13.5				<5	<5			6.2							2.3	0.77		7.9	13.5
12/26/95	7.7		6.9	11.8				<5	<5						2			3	2.1	0.50		7.9	11.8
1/2/96	8.1		6.9	12.6				<5	6.0			4.6							2.1	0.48		7.7	12.6
1/9/96	7.5		6.6	11.2				<5	6.0			5.8			5			7	3.5	0.46		8.2	11.2
1/16/96	7.5		6.6	10.8				<5	<5			12.2							3.6	0.50		7.8	10.8
1/23/96	7.6		6.4	10.2					5.0										3.7	0.79		8.1	10.2
1/30/96	7.7		6.3	10.8								32.9							3.5	0.84		8.2	10.8
2/6/96	7.8		7.0	11.6								5.6							3.1	0.54		8.5	11.6
2/13/96	7.8		7.0	11.8								6.2							2.5	0.50		8.1	11.8
3/12/96	7.9		6.9	12.3				<5											4.1	0.86		8.3	12.3
3/19/96	7.9		7.0	12.7				<5	<5			6.7			5			6	3.0	0.68		7.5	12.7
3/26/96	7.9		6.8	13.2				<5	<5			5.4							4.1	0.61		7.6	13.2
4/2/96	7.7		6.4	15.3					<5			8.6			3			4	3.4	0.95		7.4	15.3
4/9/96	8.2		6.9	16.3					15.0			2.9							4.0	0.79		7.5	16.3
4/16/96	7.8		7.0	16.3				8.5							2			3	3.8	0.83		7.7	16.3
4/23/96	8.1		6.9	17.0				8.0	9.0			2.8							3.8	0.66			17.0
4/30/96	8.2		6.7	19.1				15.0	12.0			1.3			3			4	3.6	0.75			19.1
5/7/96	8.5		6.9	19.3				18.5	14.0			2.6							3.8	0.54			19.3
5/14/96	8.1		6.8	19.8				13.5	25.0			5.8			2			3	3.3	0.90			19.8
5/21/96	8.3		7.0	17.7					22.0										3.0	0.89			17.7
5/28/96	7.5		6.7	17.8				<4.5				3.1			2			3	2.7	0.51			17.8
6/4/96	7.6		6.4	24.0				12.57	<4.5			2.3							2.6	0.54			24.0
6/11/96	7.4		6.5	22.6				<4.5	<4.5			2.4			1			2	2.5	0.31			22.6
6/18/96	7.5		6.7	21.4				<4.5	<4.5			2.8							2.6	0.35			21.4
6/25/96	7.7		7.0	20.7				<4.5	<4.5			1.6							2.7	0.45			20.7

C-031051

C-031051

Utility ID: ACWD (ACWD, CCWD, EBMUD, MWD, SCVWD)

1. Study ID: Enh. Coagulation (from EC study data) (Optimization Study 9/95, etc.)

2. Source water: River (River, lake, groundwater, etc.)

3. Source water ID: South Bay Aqueduct (State Project water, blend of...., etc.)

5. Describe level of study:
(indicate with an 'X')

	Bench-scale
	Pilot-scale
x	Full-scale

In this data sheet, "Filt." refers to data collected after coagulation, flocculation, sedimentation, and filtration.

6. Indicate with an 'X' if data reported as "Filt." are from samples collected after sedimentation only: x
or after sedimentation and filtration: x

WATER QUALITY DATA: CONVENTIONAL

Date	Time	TOC (mg/L)			Alkalinity (mg/L as CaCO3)		Hardness (mg/L as CaCO3)				Turbidity (NTU)		pH ()		Temperature (deg. C)	
		Raw	Filt.	Filt.	Raw	Filt.	Total		Calcium		Raw	Filt.	Raw	Filt.	Raw	Filt.
							Raw	Filt.	Raw	Filt.						
			(settled)	(filt)								(settled)				
		3.2	1.9		104		132				11.5	2.2	7.7		21.2	
		3.1	2.1		105		118				6.0167	1.1	8.1		20.3	
		3.7	2.8	2.4	112		120				4.65	1.7	7.6		17.3	
		4.0	2.7	2.8	127		150				2.1667	0.8	7.9		19.1	
		3.6	2.6	2.5	128		144				2.1167	2.3	7.9		19.9	
		5.8	4.0	3.4	152		142				24.333	6.9	7.9		10	
		5.6	4.2	3.7	158		144				11.933	4.4	8.4		11.1	
		5.8	4.1	3.7	127		134				8.2833	2.4	8.1		11.3	
		6.1	3.8	3.2	110		144				17.117	3.9	8.2		12.5	
		5.8	3.6	2.9	102		120				21.233	2.6	8.3		12.4	
		6.1	3.3		117		134				76.667	13.4	8		11.9	
		5.9	4.3	3.6	96		116				13.633	2.7	8.6		15	
		5.6	4.0	3.1	87		124				8.9667	2.6	8.7		14.6	
		5.8	4.2	3.5	98		118				11.55	3.4	8.5		15.5	
		5.3	3.7	3.4	105		126				10.783	3.3	8.3		15.7	
		5.1	3.7	2.8	78		108				8.6833	2.5	7.9		16.1	
		3.2	2.00		104		132				11.5	2.97	7.7		21.2	
		3.1	2.40		105		118				6.0167	1.53	8.1		20.3	
		3.7	3.10	2.40	112		120				4.65	1.88	7.6		17.3	
		4.0	2.80	2.80	127		150				2.1667	1.09	7.9		19.1	
		3.6	2.60	2.60	128		144				2.1167	1.00	7.9		19.9	
		5.8	3.70	3.40	152		142				24.333	3.02	7.9		10	
		5.6	4.20	3.50	158		144				11.933	2.98	8.4		11.1	
		5.8	4.10	3.50	127		134				8.2833	2.18	8.1		11.3	
		6.1	3.50	3.00	110		144				17.117	2.68	8.2		12.5	
		5.8	3.30	2.80	102		120				21.233	3.65	8.3		12.4	
		6.1	3.30		117		134				76.667	4.98	8		11.9	
		5.9	4.00	3.50	96		116				13.633	2.39	8.6		15	
		5.6	3.60	2.90	87		124				8.9667	2.18	8.7		14.6	
		5.8	3.70	3.10	98		118				11.55	2.92	8.5		15.5	
		5.3	3.50	3.20	105		126				10.783	2.30	8.3		15.7	
		5.1	3.40	2.70	78		108				8.6833	2.02	7.9		16.1	

Indicate coagulants studied:

ID	Coagulant	Chemical formula	Units
1	Alum	$Al_2(SO_4)_3 \cdot 14\ H_2O$	mg/L
2	Ferric	$FeCl_3 \cdot 6\ H_2O$	mg/L
3			
4			

TREATMENT CONDITIONS

Cl2 Conditions Chlorine dose (mg Cl2/L)	Disinfection By-products TTHM (µg/L) Raw	TTHM (µg/L) Filt.	HAA5 (µg/L) Raw	HAA5 (µg/L) Filt.	Coagulation Conditions Coagulant ID (see above)	Dose	Acid adjusted? (Y/N)	Base adjusted? (Y/N)	Coag. pH ()	Coag. temp. (deg. C)
2.34		9		6	1	25.1				
2.40		8		6	1	11.8				
2.60		8		4	1	11.6				
2.35		9		5	1	12.8				
2.20		8		6	1	12.5				
1.43		5		5	1	28				
1.57		5		6	1	21.3				
1.49		5		5	1	18.8				
1.32		4		3	1	40				
1.10		5		4	1	31.1				
1.47		4		4	1	29.4				
1.47		8		6	1	24				
1.54		5		4	1	25				
1.60		7		7	1	23.1				
1.90		5		5	1	21.2				
2.00		13		4	1	21				
2.34		9.0		6.0	2	11.2				
2.40		7.6		6.0	2	11.1				
2.60		8.0		4.0	2	8.1				
2.35		8.7		5.0	2	15.9				
2.20		7.8		6.0	2	9.2				
1.43		4.8		5.0	2	16				
1.57		5.1		6.0	2	13.5				
1.49		5.0		5.0	2	10.2				
1.32		3.6		3.0	2	23.8				
1.10		4.8		4.0	2	13.6				
1.47		3.8		4.0	2	26.1				
1.47		8.3		6.0	2	16.7				
1.54		4.9		4.0	2	18.5				
1.60		6.9		7.0	2	18				
1.90		5.4		5.0	2	16.7				
2.00		13.3		4.0	2	18				

C-031054

Utility ID: CCWD: Bollman WTP (ACWD, CCWD, EBMUD, MWD, SCVWD)

1. Study ID: Historical data 7/1/95-6/30/96 (Optimization Study 9/95, etc.)

2. Source water: Delta - Mallard Slough/Rock Slough (River, lake, groundwater, etc.)

3. Source water ID: Central Valley Project Water (State Project water, blend of...., etc.)

4. If blended source water indicate sources and proportions:

Source	%

5. Describe level of study: (indicate with an 'X')

	Bench-scale
	Pilot-scale
X	Full-scale

In this data sheet, "Filt." refers to data collected after coagulation, flocculation, sedimentation, and filtration.

6. Indicate with an 'X' if data reported as "Filt." are from samples collected after sedimentation only:
or after sedimentation and filtration: X

WATER QUALITY DATA: CONVENTIONAL

Date	Time	TOC (mg/L)		UV-254 (1/cm)		Alkalinity (mg/L as CaCO3)		Hardness (mg/L as CaCO3) Total		Hardness Calcium		Bromide (µg/L)		Ammonia (mg NH3-N/L)		Chloride (mg Cl-/L)		TDS (mg/L)		Turbidity (NTU)		pH ()	
		Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.
Jul-95						43.9	44.4	47.8	47.9			<0.1	<0.1	<0.1	0.32	21.3	21.3	90	120	3	0.05	7.8	8.8
Aug-95						42.3	42	47.1	46.6				<0.1			20.3	21.3		115	2.4	0.05	8.1	8.9
Sep-95						47.2	48.3	48.4	47.9				<0.1			16.1	16.3		110	2.4	0.05	8	9
Oct-95						52.4	54.2	53.1	54.8			<0.1	<0.1	<0.1	0.25	17.7	18	90	113	3.1	0.05	8.2	9
Nov-95						52.3	51.7	55.1	55.4				<0.1			20	20.4		120	5	0.05	8.4	8.9
Dec-95						54.7	55.5	62	61.3				<0.1			22.3	22.4		130	5.7	0.05	8	8.9
Jan-96						63.2	60.5	71.8	71.5			<0.1	<0.1	<0.1	0.28	29.6	29.8	130	160	6.8	0.05	8.5	9
Feb-96						67.7	67.4	78	75.7				<0.1			33.5	32		195	5.1	0.05	7.8	8.7
Mar-96						64.5	63.8	77.5	76.3				<0.1			34.3	34.3		195	5.5	0.05	8	8.9
Apr-96						63.8	64.3	84.3	82			<0.1	<0.1	<0.1	0.18	36.9	37.5	160	193	5	0.05	8	8.9
May-96						62.5	62.4	88.2	88.8				<0.1			44.8	45.7		210	5.4	0.05	8.2	8.8
Jun-96						54.6	55.8	71.5	73.8				<0.1			35.6	36.5		170	6.4	0.05	8.1	8.9

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Temperature (deg. C)		Bromate (µg/L)		Microbial Parameters												Raw					
				Coliforms				Giardia (cysts/100L)		Crypto. (oocysts/100L)		Viruses (#/mL)		HPC (CFU/mL)		Indicate disinfectant(s) used with an 'X'		Chlorine dose (mg Cl2/L)	Ammonia dose (mg NH3-N/L)	Incububation time (h)	
				Total (#/100mL)		Fecal (#/100mL)															
Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	chlorine	chloramine			chlorine	chloramine
	24.8			44	0	7		0	0	0	0			960	0						
	25.2			6	0	3								1750	0						
	23.7			8	0	14								410	0						
	20.8			42	0	5								480	0						
	18.1			29	0	27								3600	0						
	14.3			21	0	3		0	0	0	0			13700	0						
	12.1			26	0	5		0	0	0	0			2100	0						
	14			31	0	16		<5.3		<5.3				160	0						
	15.1			700	0	10		0		0				63700	0						
	17.8			33	0	5		0		0				880	0						
	20.5			37	0	9		0	0	0	<1			1500	0						
	21.8			7	0	1								20400	10						

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Chlorination conditions												Disinfection By-products							
			Filtered									TTHM (µg/L)		HAA5 (µg/L)		HAA6 (µg/L)		TOX (µg Cl-/L)	
Incub. temp. (deg. C)	pH ()	Residual (mg Cl2/L)	Indicate disinfectant(s) used with an 'X': chlorine	chloramine	Chlorine dose (mg Cl2/L)	Ammonia dose (mg NH3-N/L)	Incububation time (h): chlorine	chloramine	Incub. temp. (deg. C)	pH ()	Residual (mg Cl2/L)	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.
			X	X	1.7	0.37	0.24		24.8	7.2	1.2	<0.5	14.1				7.1		
			X	X	1.6	0.36	0.23		25.2	7.1	1.1		7.8				11.9		
			X	X	1.5	0.3	0.26		23.7	7.3	1.06		8.1				3.9		
			X	X	1.6	0.3	0.3		20.8	7.4	1.07	<0.5	9.8				5.4		
			X	X	1.6	0.33	0.26		18.1	7.4	1.07		14.7				5.1		
			X	X	1.7	0.33	0.54		14.3	7.3	1.07		12.6				6.7		
			X	X	1.8	0.33	0.58		12.1	7.2	1.1	<0.5	16				8.6		
			X	X	1.9	0.31	0.58		14	7.2	1.1		17				7.5		
			X	X	2	0.33	0.52		15.1	7.1	1.12		24.6				6.3		
			X	X	1.9	0.33	0.41		17.8	7.1	1.11	<0.5	24.3				9.8		
			X	X	1.8	0.33	0.31		20.5	7.2	1.17		20.3				12.6		
			X	X	1.8	0.29	0.24		21.8	7.2	0.95		19.3				13.7		

Note: Disinfection at Bollman is accomplished by a limited free chlorine contact time (see Filtered Incubation Time) followed by chloramination.
Typically 90-95% of the CT credit is achieved with free chlorine, the remainder being provided by chloramines

Indicate coagulants studied:

ID	Coagulant	Chemical formula	Units
1	Alum	Al2(SO4)3	mg/L
2			
3			
4			

TREATMENT CONDITIONS

Coagulation Conditions					
Coagulant ID (see above)	**Dose**	**Acid adjusted? (Y/N)**	**Base adjusted? (Y/N)**	**Coag. pH ()**	**Coag. temp. (deg. C)**
1	31.2	Y	N		
1	33.7	Y	N		
1	31.8	Y	N		
1	31.6	Y	N		
1	31.1	Y	N		
1	35.6	Y	N		
1	47.4	Y	N		
1	42.2	Y	N		
1	49.9	Y	N		
1	42.9	Y	N		
1	36.7	Y	N		
1	35.7	Y	N		

Utility ID:	MWD	(ACWD, CCWD, EBMUD, MWD, SCVWD)	
1. Study ID:	Jar Tests--range of %SPW/%CRW	(Optimization Study 9/95, etc.)	
2. Source water:	Surface	(River, lake, groundwater, etc.)	
3. Source water ID:	SPW, CRW	(State Project water, blend of...., etc.)	

Indicate coagulants studied:

ID	Coagulant	Chemical formula	Units
1	Alum	$Al_2(SO_4)_3 \cdot 14\,H_2O$	mg/L
2	Polymer	Cationic	mg/L
3			
4			

5. Describe level of study: (indicate with an 'X')

X	Bench-scale
	Pilot-scale
	Full-scale

In this data sheet, "Filt." refers to data collected after coagulation, flocculation, sedimentation, and filtration.

Doses include usually 3 (sometimes 2) mg/L polymer

6. Indicate with an 'X' if data reported as "Filt." are from samples collected after sedimentation only: X (60 min settling time)
or after sedimentation and filtration:

WATER QUALITY DATA: CONVENTIONAL

TREATMENT CONDITIONS

Study ID	Water		TOC (mg/L)		UV-254 (1/cm)		Alkalinity (mg/L as CaCO3)		Turbidity (NTU)		pH ()		Coagulation Conditions				
	% CRW	% SPW	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Coagulant ID (see above)	Dose	Acid adjusted? (Y/N) blank=N	Base adjusted? (Y/N) blank=N	Coag. pH ()
MWDJAR01	100		2.42	2.43	0.025		123		0.74	0.74	8.03		1	0			8.06
MWDJAR01	100		2.42	2.32	0.025	0.039	123		0.74	0.43	8.03		1	10			7.71
MWDJAR01	100		2.42	2.27	0.025	0.036	123		0.74	0.54	8.03		1	20			7.44
MWDJAR01	100		2.42	2.17	0.025	0.035	123		0.74	0.68	8.03		1	30			7.30
MWDJAR01	100		2.42	2.02	0.025	0.013	123		0.74		8.03		1	40			7.24
MWDJAR01	100		2.42	1.95	0.025	0.038	123		0.74	0.90	8.03		1	50			6.89
MWDJAR01	100		2.42	1.86	0.025	0.034	123		0.74	0.82	8.03		1	60			6.81
MWDJAR01	100		2.42	1.88	0.025	0.036	123		0.74	0.87	8.03		1	70			6.72
MWDJAR06	100		2.25	2.20	0.019	0.019	132		0.65	0.62	8.29		1	0			8.29
MWDJAR06	100		2.25	2.12	0.019	0.013	132		0.65	0.56	8.29		1	10			7.88
MWDJAR06	100		2.25	1.97	0.019	0.011	132		0.65	0.51	8.29		1	20			7.67
MWDJAR06	100		2.25	1.95	0.019	0.009	132		0.65	0.43	8.29		1	30			7.49
MWDJAR06	100		2.25	1.83	0.019	0.007	132		0.65	0.62	8.29		1	40			7.33
MWDJAR06	100		2.25	1.67	0.019	0.004	132		0.65	0.79	8.29		1	50			7.24
MWDJAR06	100		2.25	1.88	0.019	0.004	132		0.65	0.74	8.29		1	60			7.06
MWDJAR06	100		2.25	1.67	0.019	0.003	132		0.65	0.90	8.29		1	70			6.93
MWDJAR06	100		2.25	1.61	0.019	0.002	132		0.65	1.00	8.29		1	80			6.84
MWDJAR06	100		2.25	1.56	0.019	0.001	132		0.65	1.20	8.29		1	90			6.75
MWDJAR06	100		2.25	1.52	0.019	0.001	132		0.65	1.40	8.29		1	100			6.67
MWDJAR06	100		2.25	1.47	0.019	0.001	132		0.65	1.30	8.29		1	110			6.57
MWDJAR07	100		2.39	2.41	0.036	0.038	132		0.42	0.34	8.34		1	0			8.15
MWDJAR07	100		2.39	2.28	0.036	0.033	132		0.42	0.34	8.34		1	10			7.88
MWDJAR07	100		2.39	2.11	0.036	0.032	132		0.42	0.36	8.34		1	20			7.71
MWDJAR07	100		2.39	1.99	0.036	0.028	132		0.42	0.32	8.34		1	30			7.56
MWDJAR07	100		2.39	1.94	0.036	0.025	132		0.42	0.34	8.34		1	40			7.46
MWDJAR07	100		2.39	1.78	0.036	0.023	132		0.42	0.42	8.34		1	50			7.38
MWDJAR07	100		2.39	1.76	0.036	0.023	132		0.42	0.49	8.34		1	60			7.25
MWDJAR07	100		2.39	1.60	0.036	0.023	132		0.42	0.57	8.34		1	70			7.22
MWDJAR07	100		2.39	1.68	0.036	0.027	132		0.42	0.59	8.34		1	80			7.10
MWDJAR07	100		2.39	1.63	0.036	0.021	132		0.42	0.60	8.34		1	90			7.06
MWDJAR07	100		2.39	1.65	0.036	0.019	132		0.42	0.67	8.34		1	100			6.98
MWDJAR08	100		2.45	2.56	0.030	0.033	122		0.40	0.40	8.18		1	0			7.98
MWDJAR08	100		2.45	2.44	0.030	0.031	122		0.40	0.32	8.18		1	10			7.85
MWDJAR08	100		2.45	2.26	0.030	0.031	122		0.40	0.25	8.18		1	20			7.72
MWDJAR08	100		2.45	2.14	0.030	0.026	122		0.40	0.28	8.18		1	30			7.61
MWDJAR08	100		2.45	2.06	0.030	0.025	122		0.40	0.68	8.18		1	40			7.52
MWDJAR08	100		2.45	2.03	0.030	0.026	122		0.40	0.33	8.18		1	50			7.45
MWDJAR08	100		2.45	2.01	0.030	0.024	122		0.40	0.34	8.18		1	60			7.35
MWDJAR08	100		2.45	2.00	0.030	0.021	122		0.40	0.35	8.18		1	70			7.26
MWDJAR08	100		2.45	1.87	0.030	0.020	122		0.40	0.50	8.18		1	80			7.17
MWDJAR08	100		2.45	1.79	0.030	0.020	122		0.40	0.48	8.18		1	90			7.06
MWDJAR08	100		2.45	1.78	0.030	0.019	122		0.40	0.55	8.18		1	100			6.98
MWDJAR09	90		2.55	2.55	0.055		119		0.71	0.62	7.97		1	0			7.97
MWDJAR09	90		2.55	2.51	0.055	0.046	119		0.71	0.40	7.97		1	10			7.66
MWDJAR09	90		2.55	2.46	0.055	0.036	119		0.71	0.34	7.97		1	20			7.48
MWDJAR09	90		2.55	2.23	0.055	0.041	119		0.71	0.41	7.97		1	30			7.34
MWDJAR09	90		2.55	2.19	0.055	0.031	119		0.71	0.33	7.97		1	40			7.21
MWDJAR09	90		2.55	2.00	0.055	0.034	119		0.71	0.42	7.97		1	50			6.89
MWDJAR09	90		2.55	1.92	0.055	0.032	119		0.71	0.42	7.97		1	60			6.85
MWDJAR09	90		2.55	2.01	0.055		119		0.71		7.97		1	70			6.79
MWDJAR09	90		2.55	1.98	0.055		119		0.71		7.97		1	80			6.62
MWDJAR09	90		2.55	1.87	0.055		119		0.71		7.97		1	90			6.58
MWDJAR09	90		2.55	1.95	0.055		119		0.71		7.97		1	100			6.50
MWDJAR09	90		2.55	1.84	0.055		119		0.71		7.97		1	110			6.41
MWDJAR09	90		2.55	1.87	0.055		119		0.71		7.97		1	120			6.18
MWDJAR10	90		2.58	2.52	0.055	0.046	125		0.64	0.55	8.22		1	0			8.26
MWDJAR10	90		2.58	2.42	0.055	0.036	125		0.64	0.60	8.22		1	10			7.74
MWDJAR10	90		2.58	2.23	0.055	0.041	125		0.64	0.66	8.22		1	20			7.49
MWDJAR10	90		2.58	2.04	0.055	0.031	125		0.64	0.48	8.22		1	30			7.28
MWDJAR10	90		2.58	2.12	0.055	0.034	125		0.64	0.78	8.22		1	40			7.15
MWDJAR10	90		2.58	1.83	0.055	0.032	125		0.64	0.86	8.22		1	50			6.98
MWDJAR10	90		2.58	2.01	0.055	0.027	125		0.64	0.75	8.22		1	60			7.15
MWDJAR10	90		2.58	2.03	0.055	0.030	125		0.64	0.63	8.22		1	70			7.04
MWDJAR10	90		2.58	1.95	0.055	0.026	125		0.64	0.68	8.22		1	80			6.88
MWDJAR10	90		2.58	1.92	0.055	0.027	125		0.64	0.88	8.22		1	90			6.82
MWDJAR10	90		2.58	1.76	0.055	0.036	125		0.64	1.30	8.22		1	100			6.75
MWDJAR10	90		2.58	1.82	0.055	0.028	125		0.64	1.30	8.22		1	110			6.77
MWDJAR11	90		2.67	2.63	0.053	0.048	128		0.49	0.45	8.33		1	0			8.40
MWDJAR11	90		2.67	2.60	0.053	0.037	128		0.49	0.56	8.33		1	10			7.89
MWDJAR11	90		2.67	2.44	0.053	0.029	128		0.49	0.60	8.33		1	20			7.64
MWDJAR11	90		2.67	2.21	0.053	0.025	128		0.49	0.46	8.33		1	30			7.41
MWDJAR11	90		2.67	2.22	0.053	0.026	128		0.49	0.72	8.33		1	40			7.21
MWDJAR11	90		2.67	2.00	0.053	0.024	128		0.49	0.70	8.33		1	50			7.08
MWDJAR11	90		2.67	1.77	0.053	0.022	128		0.49	0.78	8.33		1	60			6.93
MWDJAR11	90		2.67	1.72	0.053	0.023	128		0.49	0.78	8.33		1	70			6.83

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Study ID	Water		TOC		UV-254		Alkalinity		Turbidity		pH		Coagulation Conditions				
	% CRW	% SPW	(mg/L)		(1/cm)		(mg/L as CaCO3)		(NTU)		()		Coagulant	Dose	Acid	Base	Coag.
			Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	ID		adjusted?	adjusted?	pH
													(see above)		(Y/N)	(Y/N)	()
															blank=N	blank=N	
MWDJAR11	90		2.67	1.66	0.053	0.026	128		0.49	0.85	8.33		1	80			6.72
MWDJAR11	90		2.67	1.67	0.053	0.022	128		0.49	1.10	8.33		1	90			6.62
MWDJAR12	90		2.95	3.00	0.042	0.043	120		0.67	0.30	8.23		1	0			8.20
MWDJAR12	90		2.95	2.76	0.042	0.032	120		0.67	0.28	8.23		1	10			7.80
MWDJAR12	90		2.95	2.63	0.042	0.032	120		0.67	0.22	8.23		1	20			7.66
MWDJAR12	90		2.95	2.50	0.042	0.031	120		0.67	0.21	8.23		1	30			7.44
MWDJAR12	90		2.95	2.35	0.042	0.029	120		0.67	0.23	8.23		1	40			7.26
MWDJAR12	90		2.95	2.33	0.042	0.029	120		0.67	0.23	8.23		1	50			7.23
MWDJAR12	90		2.95	2.12	0.042	0.032	120		0.67	0.24	8.23		1	60			7.16
MWDJAR12	90		2.95	2.01	0.042	0.029	120		0.67	0.20	8.23		1	70			7.08
MWDJAR12	90		2.95	1.95	0.042	0.029	120		0.67	0.25	8.23		1	80			7.01
MWDJAR12	90		2.95	1.90	0.042	0.027	120		0.67	0.23	8.23		1	90			6.88
MWDJAR12	90		2.95	1.86	0.042	0.028	120		0.67	0.29	8.23		1	100			6.82
MWDJAR12	90		2.95	1.82	0.042	0.027	120		0.67	0.27	8.23		1	110			6.79
MWDJAR12	90		2.95	1.74	0.042	0.028	120		0.67	0.47	8.23		1	120			6.76
MWDJAR12	90		2.95	1.70	0.042	0.028	120		0.67	0.56	8.23		1	130			6.67
MWDJAR12	90		2.95	1.71	0.042	0.026	120		0.67	0.52	8.23		1	140			6.61
MWDJAR12	90		2.95	1.62	0.042	0.026	120		0.67	0.45	8.23		1	150			6.47
MWDJAR12	90		2.95	1.61	0.042	0.027	120		0.67	0.49	8.23		1	160			6.40
MWDJAR12	90		2.95	1.54	0.042	0.027	120		0.67	0.55	8.23		1	170			6.37
MWDJAR12	90		2.95	1.62	0.042	0.028	120		0.67	1.30	8.23		1	180			6.23
MWDJAR12	90		2.95	1.57	0.042	0.026	120		0.67	1.30	8.23		1	190			6.18
MWDJAR12	90		2.95	1.69	0.042	0.052	120		0.67	3.80	8.23		1	200			6.12
MWDJAR13	90		2.25	2.26	0.034	0.035	126		0.77	0.77	8.30		1	0			8.28
MWDJAR13	90		2.25	2.08	0.034	0.023	126		0.77	0.48	8.30		1	10			7.90
MWDJAR13	90		2.25	1.86	0.034	0.021	126		0.77	0.40	8.30		1	20			7.72
MWDJAR13	90		2.25	2.00	0.034	0.019	126		0.77	0.38	8.30		1	30			7.56
MWDJAR13	90		2.25	1.92	0.034	0.018	126		0.77	0.46	8.30		1	40			7.43
MWDJAR13	90		2.25	1.86	0.034	0.018	126		0.77	0.45	8.30		1	50			7.33
MWDJAR13	90		2.25	1.80	0.034	0.018	126		0.77	0.58	8.30		1	60			7.20
MWDJAR13	90		2.25	1.76	0.034	0.015	126		0.77	0.57	8.30		1	70			7.14
MWDJAR13	90		2.25	1.66	0.034	0.013	126		0.77	0.58	8.30		1	80			7.06
MWDJAR13	90		2.25	1.62	0.034	0.013	126		0.77	0.55	8.30		1	90			6.98
MWDJAR13	90		2.25	1.52	0.034	0.012	126		0.77	0.67	8.30		1	100			6.94
MWDJAR13	90		2.25	1.51	0.034	0.012	126		0.77	0.78	8.30		1	110			6.88
MWDJAR14	90		2.31	2.48	0.033	0.033	127		0.58	0.54	8.20		1	0			8.22
MWDJAR14	90		2.31	2.45	0.033	0.025	127		0.58	0.55	8.20		1	10			7.95
MWDJAR14	90		2.31	2.38	0.033	0.023	127		0.58	0.44	8.20		1	20			7.71
MWDJAR14	90		2.31	2.21	0.033	0.021	127		0.58	0.48	8.20		1	30			7.52
MWDJAR14	90		2.31	2.09	0.033	0.020	127		0.58	0.67	8.20		1	40			7.40
MWDJAR14	90		2.31	1.98	0.033	0.018	127		0.58	0.39	8.20		1	50			7.31
MWDJAR14	90		2.31	1.77	0.033	0.017	127		0.58	0.68	8.20		1	60			7.27
MWDJAR14	90		2.31	1.74	0.033	0.015	127		0.58	0.77	8.20		1	70			7.13
MWDJAR14	90		2.31	1.67	0.033	0.017	127		0.58	0.82	8.20		1	80			7.06
MWDJAR14	90		2.31	1.60	0.033	0.015	127		0.58	0.70	8.20		1	90			6.93
MWDJAR14	90		2.31	1.55	0.033	0.015	127		0.58	0.95	8.20		1	100			6.84
MWDJAR14	90		2.31	1.52	0.033	0.014	127		0.58	1.00	8.20		1	110			6.77
MWDJAR14	90		2.31	1.49	0.033	0.015	127		0.58	1.00	8.20		1	120			6.60
MWDJAR14	90		2.31	1.46	0.033	0.016	127		0.58	1.00	8.20		1	130			6.53
MWDJAR14	90		2.31	1.48	0.033		127		0.58		8.20		1	140			
MWDJAR14	90		2.31	1.42	0.033		127		0.58		8.20		1	150			
MWDJAR14	90		2.31	1.33	0.033		127		0.58		8.20		1	160			
MWDJAR15	90		3.17	2.51	0.036	0.041	127		0.47	0.35	8.29		1	0			8.30
MWDJAR15	90		3.17	2.37	0.036	0.034	127		0.47	0.54	8.29		1	10			7.96
MWDJAR15	90		3.17	2.24	0.036	0.031	127		0.47	0.39	8.29		1	20			7.74
MWDJAR15	90		3.17	2.06	0.036	0.028	127		0.47	0.27	8.29		1	30			7.52
MWDJAR15	90		3.17	2.01	0.036	0.026	127		0.47	0.59	8.29		1	40			7.39
MWDJAR15	90		3.17	1.86	0.036	0.028	127		0.47	0.56	8.29		1	50			7.32
MWDJAR15	90		3.17	1.76	0.036	0.025	127		0.47	0.58	8.29		1	60			7.23
MWDJAR15	90		3.17	1.72	0.036	0.024	127		0.47	0.65	8.29		1	70			7.15
MWDJAR15	90		3.17	1.66	0.036	0.024	127		0.47	0.77	8.29		1	80			7.06
MWDJAR15	90		3.17	1.54	0.036	0.024	127		0.47	0.63	8.29		1	90			7.03
MWDJAR15	90		3.17	1.58	0.036	0.022	127		0.47	0.78	8.29		1	100			6.93
MWDJAR16	90		2.43	2.52	0.041	0.042	117		0.42	0.32	8.25		1	0			8.28
MWDJAR16	90		2.43	2.50	0.041	0.031	117		0.42	0.35	8.25		1	10			8.01
MWDJAR16	90		2.43	2.32	0.041	0.026	117		0.42	0.28	8.25		1	20			7.80
MWDJAR16	90		2.43	2.19	0.041	0.025	117		0.42	0.24	8.25		1	30			7.68
MWDJAR16	90		2.43	2.05	0.041	0.024	117		0.42	0.27	8.25		1	40			7.55
MWDJAR16	90		2.43	2.06	0.041	0.024	117		0.42	0.30	8.25		1	50			7.44
MWDJAR16	90		2.43	1.99	0.041	0.022	117		0.42	0.30	8.25		1	60			7.36
MWDJAR16	90		2.43	1.92	0.041	0.021	117		0.42	0.35	8.25		1	70			7.27
MWDJAR16	90		2.43	1.87	0.041	0.021	117		0.42	0.33	8.25		1	80			7.16
MWDJAR16	90		2.43	1.82	0.041	0.021	117		0.42	0.36	8.25		1	90			7.07
MWDJAR16	90		2.43	1.85	0.041	0.021	117		0.42	0.36	8.25		1	100			7.00
MWDJAR16	90		2.43	1.75	0.041	0.020	117		0.42	0.39	8.25		1	110			6.84
MWDJAR16	90		2.43	1.73	0.041	0.019	117		0.42	0.46	8.25		1	120			6.77
MWDJAR16	90		2.43	1.76	0.041	0.018	117		0.42	0.55	8.25		1	130			6.65
MWDJAR16	90		2.43	1.65	0.041	0.018	117		0.42	0.53	8.25		1	140			6.61
MWDJAR16	90		2.43	1.68	0.041	0.017	117		0.42	0.62	8.25		1	150			6.51
MWDJAR16	90		2.43	1.60	0.041	0.016	117		0.42	0.80	8.25		1	160			6.50
MWDJAR16	90		2.43	1.49	0.041	0.015	117		0.42	0.91	8.25		1	170			6.61
MWDJAR16	90		2.43	1.61	0.041	0.014	117		0.42	1.10	8.25		1	180			6.48
MWDJAR16	90		2.43	1.64	0.041	0.013	117		0.42	1.10	8.25		1	190			6.38
MWDJAR16	90		2.43	1.55	0.041	0.014	117		0.42	1.40	8.25		1	200			6.26
MWDJAR16	90		2.43	1.52	0.041	0.013	117		0.42	0.93	8.25		1	210			6.18
MWDJAR16	90		2.43	1.58	0.041	0.013	117		0.42	1.10	8.25		1	220			6.12
MWDJAR17	80		2.55	2.55	0.061		114		1.20	1.20	8.09		1	0			8.04
MWDJAR17	80		2.55	2.61	0.061	0.048	114		1.20	0.49	8.09		1	10			7.68
MWDJAR17	80		2.55	2.55	0.061	0.042	114		1.20	0.41	8.09		1	20			7.46
MWDJAR17	80		2.55	2.39	0.061	0.041	114		1.20	0.34	8.09		1	30			7.24
MWDJAR17	80		2.55	2.39	0.061	0.034	114		1.20	0.61	8.09		1	40			7.15
MWDJAR17	80		2.55	2.13	0.061	0.033	114		1.20	0.39	8.09		1	50			7.01

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Study ID	Water		TOC		UV-254		Alkalinity		Turbidity		pH		Coagulation Conditions				
	% CRW	% SPW	(mg/L)		(1/cm)		(mg/L as CaCO3)		(NTU)		()		Coagulant	Dose	Acid	Base	Coag.
			Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	ID		adjusted?	adjusted?	pH
													(see above)		(Y/N)	(Y/N)	()
															blank=N	blank=N	
MWDJAR17	80		2.55	2.02	0.061	0.034	114		1.20	0.44	8.09		1	60			6.95
MWDJAR17	80		2.55	1.96	0.061	0.042	114		1.20	1.10	8.09		1	70			6.60
MWDJAR17	80		2.55	1.84	0.061	0.032	114		1.20	0.95	8.09		1	80			6.51
MWDJAR17	80		2.55	1.74	0.061	0.031	114		1.20	0.85	8.09		1	90			6.43
MWDJAR17	80		2.55	1.64	0.061	0.033	114		1.20	1.40	8.09		1	100			6.27
MWDJAR17	80		2.55	1.67	0.061	0.033	114		1.20	1.20	8.09		1	110			6.17
MWDJAR17	80		2.55	1.62	0.061	0.033	114		1.20	1.30	8.09		1	120			6.14
MWDJAR18	80		2.45	2.59	0.054	0.061	121		0.78	0.68	8.22		1	0			8.23
MWDJAR18	80		2.45	2.66	0.054	0.045	121		0.78	0.66	8.22		1	10			7.85
MWDJAR18	80		2.45	2.54	0.054	0.039	121		0.78	0.60	8.22		1	20			7.61
MWDJAR18	80		2.45	2.32	0.054	0.036	121		0.78	0.65	8.22		1	30			7.45
MWDJAR18	80		2.45	2.35	0.054	0.041	121		0.78	0.54	8.22		1	40			7.35
MWDJAR18	80		2.45	2.22	0.054	0.032	121		0.78	0.67	8.22		1	50			7.23
MWDJAR18	80		2.45	1.95	0.054	0.034	121		0.78	0.82	8.22		1	60			6.97
MWDJAR18	80		2.45	1.97	0.054	0.032	121		0.78	0.76	8.22		1	70			7.00
MWDJAR18	80		2.45	1.77	0.054	0.031	121		0.78	0.78	8.22		1	80			6.90
MWDJAR18	80		2.45	1.82	0.054	0.034	121		0.78	0.75	8.22		1	90			6.88
MWDJAR18	80		2.45	1.76	0.054	0.035	121		0.78	0.73	8.22		1	100			6.82
MWDJAR18	80		2.45	1.75	0.054	0.037	121		0.78	1.00	8.22		1	110			6.77
MWDJAR19	80		2.70	2.87	0.049	0.048	122		0.57	0.55	8.38		1	0			8.46
MWDJAR19	80		2.70	2.65	0.049	0.031	122		0.57	0.69	8.38		1	10			7.85
MWDJAR19	80		2.70	2.44	0.049	0.027	122		0.57	0.60	8.38		1	20			7.64
MWDJAR19	80		2.70	2.22	0.049	0.025	122		0.57	0.56	8.38		1	30			7.32
MWDJAR19	80		2.70	2.04	0.049	0.023	122		0.57	0.59	8.38		1	40			7.18
MWDJAR19	80		2.70	2.02	0.049	0.021	122		0.57	0.79	8.38		1	50			7.13
MWDJAR19	80		2.70	1.97	0.049	0.021	122		0.57	0.75	8.38		1	60			6.80
MWDJAR19	80		2.70	1.85	0.049	0.018	122		0.57	0.81	8.38		1	70			6.79
MWDJAR19	80		2.70	1.78	0.049	0.018	122		0.57	0.97	8.38		1	80			6.71
MWDJAR19	80		2.70	1.88	0.049	0.015	122		0.57	0.89	8.38		1	90			6.67
MWDJAR19	80		2.70	1.77	0.049	0.015	122		0.57	0.84	8.38		1	100			6.56
MWDJAR19	80		2.70	1.88	0.049	0.016	122		0.57	1.50	8.38		1	110			6.52
MWDJAR2	100		2.53	2.90	0.042	0.045	133		0.85	0.90	8.38		1	0			8.45
MWDJAR2	100		2.53	2.89	0.042	0.036	133		0.85	0.71	8.38		1	10			8.02
MWDJAR2	100		2.53	2.68	0.042	0.030	133		0.85	0.53	8.38		1	20			7.72
MWDJAR2	100		2.53	2.51	0.042	0.027	133		0.85	0.40	8.38		1	30			7.46
MWDJAR2	100		2.53	2.19	0.042	0.029	133		0.85	0.64	8.38		1	40			7.34
MWDJAR2	100		2.53	2.30	0.042	0.028	133		0.85	0.57	8.38		1	50			7.26
MWDJAR2	100		2.53	2.03	0.042	0.017	133		0.85	0.78	8.38		1	60			6.96
MWDJAR2	100		2.53	1.99	0.042	0.016	133		0.85	1.10	8.38		1	70			6.85
MWDJAR2	100		2.53	1.90	0.042	0.018	133		0.85	1.20	8.38		1	80			6.84
MWDJAR2	100		2.53	1.90	0.042	0.020	133		0.85	1.30	8.38		1	90			6.81
MWDJAR20	80		2.79	2.87	0.053	0.055	114		0.54	0.38	8.21		1	0			8.15
MWDJAR20	80		2.79	2.46	0.053	0.040	114		0.54	0.37	8.21		1	10			7.45
MWDJAR20	80		2.79	2.60	0.053	0.044	114		0.54	0.25	8.21		1	20			7.58
MWDJAR20	80		2.79	2.39	0.053	0.038	114		0.54	0.24	8.21		1	30			7.42
MWDJAR20	80		2.79	2.28	0.053	0.035	114		0.54	0.24	8.21		1	40			7.30
MWDJAR20	80		2.79	2.20	0.053	0.036	114		0.54	0.20	8.21		1	50			7.21
MWDJAR20	80		2.79	2.13	0.053	0.036	114		0.54	0.20	8.21		1	60			7.19
MWDJAR20	80		2.79	2.03	0.053	0.032	114		0.54	0.23	8.21		1	70			7.10
MWDJAR20	80		2.79	1.97	0.053	0.034	114		0.54	0.26	8.21		1	80			7.01
MWDJAR20	80		2.79	1.95	0.053	0.033	114		0.54	0.27	8.21		1	90			6.97
MWDJAR20	80		2.79	1.83	0.053	0.032	114		0.54	0.27	8.21		1	100			6.82
MWDJAR20	80		2.79	1.79	0.053	0.031	114		0.54	0.63	8.21		1	110			6.80
MWDJAR20	80		2.79	1.74	0.053	0.031	114		0.54	0.39	8.21		1	120			6.74
MWDJAR20	80		2.79	1.70	0.053	0.027	114		0.54	0.43	8.21		1	130			6.62
MWDJAR20	80		2.79	1.62	0.053	0.032	114		0.54	0.53	8.21		1	140			6.48
MWDJAR20	80		2.79	1.61	0.053	0.030	114		0.54	0.58	8.21		1	150			6.53
MWDJAR20	80		2.79	1.61	0.053	0.030	114		0.54	0.53	8.21		1	160			6.42
MWDJAR20	80		2.79	1.63	0.053	0.048	114		0.54	0.60	8.21		1	170			6.33
MWDJAR20	80		2.79	1.47	0.053	0.032	114		0.54	1.20	8.21		1	180			6.19
MWDJAR20	80		2.79	1.55	0.053	0.032	114		0.54	1.40	8.21		1	190			6.10
MWDJAR20	80		2.79	1.52	0.053	0.027	114		0.54	1.50	8.21		1	200			6.08
MWDJAR21	80		2.43	2.42	0.036	0.038	121		0.83	0.73	8.22		1	0			8.23
MWDJAR21	80		2.43	2.42	0.036	0.028	121		0.83	0.69	8.22		1	10			7.94
MWDJAR21	80		2.43	2.29	0.036	0.025	121		0.83	0.52	8.22		1	20			7.60
MWDJAR21	80		2.43	2.09	0.036	0.023	121		0.83	0.32	8.22		1	30			7.47
MWDJAR21	80		2.43	2.04	0.036	0.021	121		0.83	0.46	8.22		1	40			7.35
MWDJAR21	80		2.43	1.97	0.036	0.019	121		0.83	0.57	8.22		1	50			7.28
MWDJAR21	80		2.43	1.80	0.036	0.017	121		0.83	0.51	8.22		1	60			7.30
MWDJAR21	80		2.43	1.77	0.036	0.017	121		0.83	0.57	8.22		1	70			7.28
MWDJAR21	80		2.43	1.73	0.036	0.015	121		0.83	0.67	8.22		1	80			7.13
MWDJAR21	80		2.43	1.72	0.036	0.014	121		0.83	0.71	8.22		1	90			7.06
MWDJAR21	80		2.43	1.70	0.036	0.014	121		0.83	0.72	8.22		1	100			6.96
MWDJAR21	80		2.43	1.69	0.036	0.013	121		0.83	0.98	8.22		1	110			6.95
MWDJAR22	80		2.41	2.53	0.038	0.038	121		0.78	0.71	8.15		1	0			8.25
MWDJAR22	80		2.41	2.31	0.038	0.029	121		0.78	0.50	8.15		1	10			7.92
MWDJAR22	80		2.41	2.23	0.038	0.027	121		0.78	0.68	8.15		1	20			7.71
MWDJAR22	80		2.41	2.04	0.038	0.021	121		0.78	0.55	8.15		1	30			7.52
MWDJAR22	80		2.41	1.96	0.038	0.019	121		0.78	0.50	8.15		1	40			7.43
MWDJAR22	80		2.41	1.90	0.038	0.018	121		0.78	0.38	8.15		1	50			7.30
MWDJAR22	80		2.41	1.81	0.038	0.018	121		0.78	0.73	8.15		1	60			7.03
MWDJAR22	80		2.41	1.74	0.038	0.017	121		0.78	0.85	8.15		1	70			6.90
MWDJAR22	80		2.41	1.68	0.038	0.016	121		0.78	0.80	8.15		1	80			6.83
MWDJAR22	80		2.41	1.64	0.038	0.016	121		0.78	0.76	8.15		1	90			6.76
MWDJAR22	80		2.41	1.58	0.038	0.015	121		0.78	0.81	8.15		1	100			6.72
MWDJAR22	80		2.41	1.56	0.038	0.015	121		0.78	0.93	8.15		1	110			6.70
MWDJAR22	80		2.41	1.42	0.038	0.015	121		0.78	0.95	8.15		1	120			6.55
MWDJAR22	80		2.41	1.33	0.038	0.016	121		0.78	0.95	8.15		1	130			6.50
MWDJAR23	80		2.51	2.56	0.050	0.055	121		0.43	0.45	8.32		1	0			8.33
MWDJAR23	80		2.51	2.43	0.050	0.042	121		0.43	0.58	8.32		1	10			7.92
MWDJAR23	80		2.51	2.25	0.050	0.035	121		0.43	0.44	8.32		1	20			7.65
MWDJAR23	80		2.51	2.12	0.050	0.030	121		0.43	0.50	8.32		1	30			7.49

C-031060

C-031060

Study ID	Water		TOC		UV-254		Alkalinity		Turbidity		pH		Coagulation Conditions				
	% CRW	% SPW	(mg/L)		(1/cm)		(mg/L as CaCO3)		(NTU)		()		Coagulant	Dose	Acid	Base	Coag.
			Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	ID		adjusted?	adjusted?	pH
													(see above)		(Y/N)	(Y/N)	()
															blank=N	blank=N	
MWDJAR23	80		2.51	2.00	0.050	0.028	121		0.43	0.36	8.32		1	40			7.39
MWDJAR23	80		2.51	1.92	0.050	0.024	121		0.43	0.40	8.32		1	50			7.28
MWDJAR23	80		2.51	1.79	0.050	0.023	121		0.43	0.42	8.32		1	60			7.21
MWDJAR23	80		2.51	1.75	0.050	0.018	121		0.43	0.45	8.32		1	70			7.16
MWDJAR23	80		2.51	1.62	0.050	0.022	121		0.43	0.48	8.32		1	80			7.07
MWDJAR23	80		2.51	1.56	0.050	0.019	121		0.43	0.55	8.32		1	90			7.00
MWDJAR23	80		2.51	1.56	0.050	0.022	121		0.43	0.58	8.32		1	100			6.95
MWDJAR24	80		2.57	2.45	0.045	0.046	113		0.65	0.59	8.11		1	0			8.20
MWDJAR24	80		2.57	2.49	0.045	0.035	113		0.65	0.32	8.11		1	10			7.95
MWDJAR24	80		2.57	2.32	0.045	0.031	113		0.65	0.29	8.11		1	20			7.80
MWDJAR24	80		2.57	2.09	0.045	0.027	113		0.65	0.28	8.11		1	30			7.62
MWDJAR24	80		2.57	2.05	0.045	0.027	113		0.65	0.28	8.11		1	40			7.50
MWDJAR24	80		2.57	1.90	0.045	0.026	113		0.65	0.27	8.11		1	50			7.39
MWDJAR24	80		2.57	1.90	0.045	0.025	113		0.65	0.27	8.11		1	60			7.19
MWDJAR24	80		2.57	2.03	0.045	0.023	113		0.65	0.27	8.11		1	70			7.11
MWDJAR24	80		2.57	1.92	0.045	0.021	113		0.65	0.28	8.11		1	80			7.03
MWDJAR24	80		2.57	1.80	0.045	0.021	113		0.65	0.40	8.11		1	90			6.93
MWDJAR24	80		2.57	1.69	0.045	0.021	113		0.65	0.44	8.11		1	100			6.90
MWDJAR24	80		2.57	1.61	0.045	0.020	113		0.65	0.45	8.11		1	110			6.86
MWDJAR24	80		2.57	1.61	0.045	0.020	113		0.65	0.54	8.11		1	120			6.78
MWDJAR24	80		2.57	1.64	0.045	0.020	113		0.65	0.62	8.11		1	130			6.67
MWDJAR24	80		2.57	1.55	0.045	0.019	113		0.65	0.80	8.11		1	140			6.58
MWDJAR24	80		2.57	1.69	0.045	0.018	113		0.65	1.20	8.11		1	150			6.53
MWDJAR24	80		2.57	1.57	0.045	0.018	113		0.65	1.20	8.11		1	160			6.45
MWDJAR24	80		2.57	1.44	0.045	0.017	113		0.65	0.89	8.11		1	170			6.37
MWDJAR24	80		2.57	1.46	0.045	0.017	113		0.65	1.53	8.11		1	180			6.30
MWDJAR24	80		2.57	1.36	0.045	0.016	113		0.65	0.76	8.11		1	190			6.22
MWDJAR24	80		2.57	1.35	0.045	0.015	113		0.65	0.77	8.11		1	200			6.13
MWDJAR24	80		2.57	1.40	0.045	0.015	113		0.65	0.75	8.11		1	210			6.04
MWDJAR24	80		2.57	1.29	0.045	0.015	113		0.65	0.95	8.11		1	220			5.91
MWDJAR25	70		2.67	2.67	0.065		109		0.84	0.75	7.84		1	0			7.92
MWDJAR25	70		2.67	2.59	0.065	0.054	109		0.84	0.65	7.84		1	10			7.64
MWDJAR25	70		2.67	2.49	0.065	0.049	109		0.84	0.65	7.84		1	20			7.41
MWDJAR25	70		2.67	2.20	0.065	0.039	109		0.84	0.43	7.84		1	30			7.13
MWDJAR25	70		2.67	2.10	0.065	0.037	109		0.84	0.50	7.84		1	40			6.98
MWDJAR25	70		2.67	1.97	0.065	0.037	109		0.84	0.76	7.84		1	50			6.85
MWDJAR25	70		2.67	1.92	0.065	0.035	109		0.84	0.77	7.84		1	60			6.72
MWDJAR25	70		2.67	1.82	0.065	0.028	109		0.84	0.90	7.84		1	70			6.58
MWDJAR25	70		2.67	1.82	0.065	0.026	109		0.84	0.85	7.84		1	80			6.50
MWDJAR25	70		2.67	1.66	0.065	0.026	109		0.84	0.87	7.84		1	90			6.42
MWDJAR25	70		2.67	1.68	0.065	0.024	109		0.84	0.95	7.84		1	100			6.22
MWDJAR26	70		2.50	2.56	0.055	0.058	115		0.68	0.82	8.22		1	0			8.22
MWDJAR26	70		2.50	2.53	0.055	0.046	115		0.68	0.76	8.22		1	10			7.79
MWDJAR26	70		2.50	2.39	0.055	0.041	115		0.68	0.78	8.22		1	20			7.57
MWDJAR26	70		2.50	2.29	0.055	0.038	115		0.68	0.75	8.22		1	30			7.43
MWDJAR26	70		2.50	2.01	0.055	0.035	115		0.68	0.73	8.22		1	40			7.28
MWDJAR26	70		2.50	2.02	0.055	0.035	115		0.68	1.00	8.22		1	50			7.18
MWDJAR26	70		2.50	1.96	0.055	0.033	115		0.68	0.67	8.22		1	60			6.97
MWDJAR26	70		2.50	1.75	0.055	0.034	115		0.68	0.70	8.22		1	70			7.00
MWDJAR26	70		2.50	1.75	0.055	0.036	115		0.68	0.70	8.22		1	80			6.81
MWDJAR26	70		2.50	1.71	0.055	0.031	115		0.68	0.41	8.22		1	90			6.78
MWDJAR26	70		2.50	1.62	0.055	0.034	115		0.68	0.57	8.22		1	100			6.77
MWDJAR26	70		2.50	1.72	0.055	0.031	115		0.68	0.72	8.22		1	110			6.56
MWDJAR26	70		2.50	1.63	0.055	0.032	115		0.68	1.20	8.22		1	120			6.46
MWDJAR26	70		2.50	1.56	0.055	0.033	115		0.68	1.40	8.22		1	130			6.39
MWDJAR26	70		2.50	1.57	0.055	0.035	115		0.68	1.70	8.22		1	140			6.33
MWDJAR27	70		3.14	2.94	0.064	0.061	115		0.69	0.62	8.32		1	0			8.29
MWDJAR27	70		3.14	2.38	0.064	0.027	115		0.69	0.48	8.32		1	10			7.24
MWDJAR27	70		3.14	2.62	0.064	0.030	115		0.69	0.43	8.32		1	20			7.33
MWDJAR27	70		3.14	2.48	0.064	0.029	115		0.69	0.41	8.32		1	30			7.25
MWDJAR27	70		3.14	2.44	0.064	0.027	115		0.69	0.52	8.32		1	40			7.05
MWDJAR27	70		3.14	2.14	0.064	0.024	115		0.69	0.55	8.32		1	50			6.99
MWDJAR27	70		3.14	3.87	0.064	0.029	115		0.69	0.61	8.32		1	60			6.78
MWDJAR27	70		3.14	2.81	0.064	0.020	115		0.69	0.71	8.32		1	70			6.67
MWDJAR27	70		3.14	1.93	0.064	0.020	115		0.69	0.62	8.32		1	80			6.63
MWDJAR27	70		3.14	1.83	0.064	0.018	115		0.69	0.74	8.32		1	90			6.56
MWDJAR27	70		3.14	1.72	0.064	0.029	115		0.69	0.84	8.32		1	100			6.42
MWDJAR27	70		3.14	1.96	0.064		115		0.69	1.00	8.32		1	110			6.33
MWDJAR27	70		3.14	1.72	0.064	0.025	115		0.69	1.70	8.32		1	120			6.19
MWDJAR27	70		3.14	1.92	0.064	0.019	115		0.69	2.10	8.32		1	130			6.15
MWDJAR27	70		3.14	1.76	0.064	0.017	115		0.69	1.70	8.32		1	140			6.05
MWDJAR27	70		3.14	1.75	0.064	0.016	115		0.69	3.10	8.32		1	150			5.85
MWDJAR28	70		2.74	2.82	0.058	0.057	111		0.47	0.37	8.12		1	0			8.17
MWDJAR28	70		2.74	2.63	0.058	0.047	111		0.47	0.22	8.12		1	10			7.91
MWDJAR28	70		2.74	2.45	0.058	0.042	111		0.47	0.20	8.12		1	20			7.80
MWDJAR28	70		2.74	2.39	0.058	0.039	111		0.47	0.17	8.12		1	30			7.59
MWDJAR28	70		2.74	2.27	0.058	0.033	111		0.47	0.16	8.12		1	40			7.47
MWDJAR28	70		2.74	2.17	0.058	0.039	111		0.47	0.21	8.12		1	50			7.37
MWDJAR28	70		2.74	2.04	0.058	0.032	111		0.47	0.22	8.12		1	60			7.25
MWDJAR28	70		2.74	2.02	0.058	0.030	111		0.47	0.22	8.12		1	70			7.09
MWDJAR28	70		2.74	1.96	0.058	0.027	111		0.47	0.24	8.12		1	80			7.04
MWDJAR28	70		2.74	1.88	0.058	0.027	111		0.47	0.21	8.12		1	90			6.89
MWDJAR28	70		2.74	1.82	0.058	0.028	111		0.47	0.28	8.12		1	100			6.89
MWDJAR28	70		2.74	1.82	0.058	0.030	111		0.47	0.27	8.12		1	110			6.78
MWDJAR28	70		2.74	1.71	0.058	0.025	111		0.47	0.33	8.12		1	120			6.73
MWDJAR28	70		2.74	1.63	0.058	0.029	111		0.47	0.50	8.12		1	130			6.63
MWDJAR28	70		2.74	1.70	0.058	0.030	111		0.47	0.53	8.12		1	140			6.55
MWDJAR28	70		2.74	1.74	0.058	0.027	111		0.47	0.45	8.12		1	150			6.41
MWDJAR28	70		2.74	1.58	0.058	0.026	111		0.47	0.45	8.12		1	160			6.35
MWDJAR28	70		2.74	1.81	0.058	0.044	111		0.47	0.58	8.12		1	170			6.40
MWDJAR28	70		2.74	1.68	0.058	0.023	111		0.47	0.63	8.12		1	180			6.33
MWDJAR28	70		2.74	1.67	0.058	0.041	111		0.47	0.67	8.12		1	190			6.23

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Study ID	Water		TOC		UV-254		Alkalinity		Turbidity		pH		Coagulation Conditions				
	% CRW	% SPW	(mg/L)		(1/cm)		(mg/L as CaCO3)		(NTU)		()		Coagulant	Dose	Acid	Base	Coag.
			Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	ID		adjusted?	adjusted?	pH
													(see above)		(Y/N)	(Y/N)	()
															blank=N	blank=N	
MWDJAR29	70		2.50	2.55	0.040	0.040	115		0.68	0.68	8.20		1	0			8.20
MWDJAR29	70		2.50	2.44	0.040	0.030	115		0.68	0.58	8.20		1	10			7.92
MWDJAR29	70		2.50	2.25	0.040	0.026	115		0.68	0.52	8.20		1	20			7.69
MWDJAR29	70		2.50	2.12	0.040	0.023	115		0.68	0.44	8.20		1	30			7.51
MWDJAR29	70		2.50	1.97	0.040	0.020	115		0.68	0.54	8.20		1	40			7.48
MWDJAR29	70		2.50	1.91	0.040	0.020	115		0.68	0.72	8.20		1	50			7.39
MWDJAR29	70		2.50	1.80	0.040	0.019	115		0.68	0.77	8.20		1	60			7.06
MWDJAR29	70		2.50	1.76	0.040	0.018	115		0.68	0.86	8.20		1	70			6.99
MWDJAR29	70		2.50	1.76	0.040	0.018	115		0.68	0.61	8.20		1	80			6.93
MWDJAR29	70		2.50	1.67	0.040	0.017	115		0.68	0.50	8.20		1	90			6.90
MWDJAR29	70		2.50	1.62	0.040	0.016	115		0.68	0.60	8.20		1	100			6.87
MWDJAR29	70		2.50	1.60	0.040	0.015	115		0.68	0.78	8.20		1	110			6.80
MWDJAR29	70		2.50	1.49	0.040	0.015	115		0.68	1.00	8.20		1	120			6.72
MWDJAR29	70		2.50	1.47	0.040	0.017	115		0.68	1.10	8.20		1	130			6.63
MWDJAR29	70		2.50	1.47	0.040	0.016	115		0.68	1.00	8.20		1	140			6.58
MWDJAR29	70		2.50	1.41	0.040	0.018	115		0.68	1.10	8.20		1	150			6.40
MWDJAR29	70		2.50	1.39	0.040	0.014	115		0.68	1.20	8.20		1	160			6.33
MWDJAR29	70		2.50	1.37	0.040	0.014	115		0.68	1.20	8.20		1	170			6.27
MWDJAR3	100		2.50	2.55	0.040	0.037	134		0.42	0.35	8.41		1	0			8.40
MWDJAR3	100		2.50	2.30	0.040	0.029	134		0.42	0.49	8.41		1	10			7.84
MWDJAR3	100		2.50	2.10	0.040	0.029	134		0.42	0.49	8.41		1	20			7.63
MWDJAR3	100		2.50	2.00	0.040	0.025	134		0.42	0.41	8.41		1	30			7.39
MWDJAR3	100		2.50	1.94	0.040	0.023	134		0.42	0.60	8.41		1	40			7.32
MWDJAR3	100		2.50	1.85	0.040	0.022	134		0.42	0.61	8.41		1	50			7.13
MWDJAR3	100		2.50	1.78	0.040	0.022	134		0.42	0.78	8.41		1	60			6.93
MWDJAR3	100		2.50	1.65	0.040	0.019	134		0.42	0.86	8.41		1	70			6.90
MWDJAR3	100		2.50	1.60	0.040	0.020	134		0.42	1.10	8.41		1	80			6.84
MWDJAR30	70		2.44	2.51	0.042	0.042	116		0.8	0.58	8.14		1	0			8.12
MWDJAR30	70		2.44	2.36	0.042	0.032	116		0.8	0.61	8.14		1	10			7.81
MWDJAR30	70		2.44	2.20	0.042	0.027	116		0.8	0.50	8.14		1	20			7.53
MWDJAR30	70		2.44	2.04	0.042	0.024	116		0.8	0.50	8.14		1	30			7.36
MWDJAR30	70		2.44	1.96	0.042	0.022	116		0.8	0.70	8.14		1	40			7.29
MWDJAR30	70		2.44	1.83	0.042	0.021	116		0.8	0.52	8.14		1	50			7.23
MWDJAR30	70		2.44	1.92	0.042	0.019	116		0.8	0.58	8.14		1	60			7.00
MWDJAR30	70		2.44	1.86	0.042	0.019	116		0.8	0.64	8.14		1	70			6.86
MWDJAR30	70		2.44	1.88	0.042	0.017	116		0.8	0.72	8.14		1	80			6.82
MWDJAR30	70		2.44	1.84	0.042	0.016	116		0.8	0.84	8.14		1	90			6.79
MWDJAR30	70		2.44	1.83	0.042	0.015	116		0.8	1.10	8.14		1	100			6.74
MWDJAR30	70		2.44	1.79	0.042	0.015	116		0.8	0.95	8.14		1	110			6.70
MWDJAR30	70		2.44	1.27	0.042	0.019	116		0.8	0.75	8.14		1	120			6.51
MWDJAR30	70		2.44	1.26	0.042	0.018	116		0.8	1.10	8.14		1	130			6.43
MWDJAR30	70		2.44	1.24	0.042	0.017	116		0.8	0.87	8.14		1	140			6.36
MWDJAR30	70		2.44	1.24	0.042	0.016	116		0.8	1.30	8.14		1	150			6.31
MWDJAR30	70		2.44	1.13	0.042	0.015	116		0.8	1.20	8.14		1	160			6.27
MWDJAR31	70		2.60	2.56	0.053	0.053	114		0.45	0.40	8.29		1	0			8.30
MWDJAR31	70		2.60	2.44	0.053	0.052	114		0.45	0.55	8.29		1	10			7.91
MWDJAR31	70		2.60	2.22	0.053	0.036	114		0.45	0.50	8.29		1	20			7.66
MWDJAR31	70		2.60	2.10	0.053	0.033	114		0.45	0.35	8.29		1	30			7.52
MWDJAR31	70		2.60	2.00	0.053	0.031	114		0.45	0.33	8.29		1	40			7.32
MWDJAR31	70		2.60	1.94	0.053	0.029	114		0.45	0.53	8.29		1	50			7.27
MWDJAR31	70		2.60	1.87	0.053	0.028	114		0.45	0.42	8.29		1	60			7.20
MWDJAR31	70		2.60	1.81	0.053	0.026	114		0.45	0.48	8.29		1	70			7.08
MWDJAR31	70		2.60	1.72	0.053	0.024	114		0.45	0.48	8.29		1	80			7.00
MWDJAR31	70		2.60	1.62	0.053	0.023	114		0.45	0.48	8.29		1	90			6.96
MWDJAR31	70		2.60	1.62	0.053	0.023	114		0.45	0.52	8.29		1	100			6.86
MWDJAR31	70		2.60	1.58	0.053	0.021	114		0.45	0.50	8.29		1	110			6.72
MWDJAR31	70		2.60	1.52	0.053	0.021	114		0.45	0.67	8.29		1	120			6.68
MWDJAR31	70		2.60	1.47	0.053	0.020	114		0.45	0.63	8.29		1	130			6.59
MWDJAR31	70		2.60	1.50	0.053	0.020	114		0.45	0.73	8.29		1	140			6.52
MWDJAR31	70		2.60	1.46	0.053	0.019	114		0.45	0.77	8.29		1	150			6.46
MWDJAR31	70		2.60	1.40	0.053	0.018	114		0.45	0.71	8.29		1	160			6.39
MWDJAR31	70		2.60	1.26	0.053	0.018	114		0.45	1.00	8.29		1	170			6.55
MWDJAR31	70		2.60	1.30	0.053	0.017	114		0.45	1.10	8.29		1	180			6.43
MWDJAR31	70		2.60	1.17	0.053	0.017	114		0.45	1.10	8.29		1	190			6.34
MWDJAR31	70		2.60	1.12	0.053	0.016	114		0.45	1.40	8.29		1	200			6.23
MWDJAR32	70		2.49	2.51	0.048	0.047	106		0.52	0.44	8.06		1	0			8.07
MWDJAR32	70		2.49	2.36	0.048	0.047	106		0.52	0.37	8.06		1	10			7.90
MWDJAR32	70		2.49	2.18	0.048	0.040	106		0.52	0.26	8.06		1	20			7.73
MWDJAR32	70		2.49	1.96	0.048	0.042	106		0.52	0.32	8.06		1	30			7.51
MWDJAR32	70		2.49	2.09	0.048	0.035	106		0.52	0.29	8.06		1	40			7.48
MWDJAR32	70		2.49	2.04	0.048	0.030	106		0.52	0.29	8.06		1	50			7.41
MWDJAR32	70		2.49	1.81	0.048	0.027	106		0.52	0.25	8.06		1	60			7.27
MWDJAR32	70		2.49	1.80	0.048	0.022	106		0.52	0.30	8.06		1	70			7.14
MWDJAR32	70		2.49	1.74	0.048	0.022	106		0.52	0.33	8.06		1	80			7.04
MWDJAR32	70		2.49	1.73	0.048	0.022	106		0.52	0.30	8.06		1	90			6.97
MWDJAR32	70		2.49	1.67	0.048	0.023	106		0.52	0.37	8.06		1	100			6.86
MWDJAR32	70		2.49	1.67	0.048	0.023	106		0.52	0.42	8.06		1	110			6.83
MWDJAR32	70		2.49	1.60	0.048	0.021	106		0.52	0.39	8.06		1	120			6.80
MWDJAR32	70		2.49	1.59	0.048	0.019	106		0.52	0.49	8.06		1	130			6.75
MWDJAR32	70		2.49	1.62	0.048	0.018	106		0.52	0.53	8.06		1	140			6.66
MWDJAR32	70		2.49	1.52	0.048	0.018	106		0.52	0.56	8.06		1	150			6.65
MWDJAR32	70		2.49	1.55	0.048	0.018	106		0.52	0.70	8.06		1	160			6.51
MWDJAR32	70		2.49	1.56	0.048	0.017	106		0.52	0.61	8.06		1	170			6.41
MWDJAR32	70		2.49	1.41	0.048	0.017	106		0.52	0.65	8.06		1	180			6.34
MWDJAR32	70		2.49	1.39	0.048	0.017	106		0.52	0.78	8.06		1	190			6.13
MWDJAR32	70		2.49	1.50	0.048	0.015	106		0.52	0.85	8.06		1	200			6.06
MWDJAR32	70		2.49	1.37	0.048	0.015	106		0.52	0.85	8.06		1	210			5.90
MWDJAR32	70		2.49	1.33	0.048	0.015	106		0.52	1.10	8.06		1	220			5.86
MWDJAR33	60		2.72	2.69	0.074		104		1.70		8.03		1	0			7.91
MWDJAR33	60		2.72	2.62	0.074	0.062	104		1.70	0.53	8.03		1	10			7.59
MWDJAR33	60		2.72	2.50	0.074	0.055	104		1.70	0.66	8.03		1	20			7.38
MWDJAR33	60		2.72	2.40	0.074	0.048	104		1.70	0.64	8.03		1	30			7.17

C-031062

C-031062

Study ID	Water		TOC		UV-254		Alkalinity		Turbidity		pH		Coagulation Conditions				
	% CRW	% SPW	(mg/L)		(1/cm)		(mg/L as CaCO3)		(NTU)		()		Coagulant	Dose	Acid	Base	Coag.
			Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	ID		adjusted?	adjusted?	pH
													(see above)		(Y/N)	(Y/N)	()
															blank=N	blank=N	
MWDJAR33	60		2.72	2.15	0.074	0.043	104		1.70	0.75	8.03		1	40			6.98
MWDJAR33	60		2.72	2.09	0.074	0.042	104		1.70	0.84	8.03		1	50			6.92
MWDJAR33	60		2.72	2.04	0.074	0.041	104		1.70	0.86	8.03		1	60			6.77
MWDJAR33	60		2.72	1.92	0.074	0.039	104		1.70	0.81	8.03		1	70			6.49
MWDJAR33	60		2.72	1.86	0.074	0.038	104		1.70	1.10	8.03		1	80			6.33
MWDJAR33	60		2.72	1.75	0.074	0.035	104		1.70	0.97	8.03		1	90			6.26
MWDJAR33	60		2.72	1.67	0.074	0.037	104		1.70	2.00	8.03		1	100			6.11
MWDJAR34	60		2.51	2.67	0.048	0.043	109		0.77	0.67	8.27		1	0			8.27
MWDJAR34	60		2.51	2.57	0.048	0.035	109		0.77	0.70	8.27		1	10			7.79
MWDJAR34	60		2.51	2.46	0.048	0.031	109		0.77	0.70	8.27		1	20			7.57
MWDJAR34	60		2.51	2.32	0.048	0.025	109		0.77	0.41	8.27		1	30			7.43
MWDJAR34	60		2.51	2.24	0.048	0.025	109		0.77	0.57	8.27		1	40			7.28
MWDJAR34	60		2.51	2.22	0.048	0.024	109		0.77	0.72	8.27		1	50			7.18
MWDJAR34	60		2.51	1.91	0.048	0.021	109		0.77	0.57	8.27		1	60			7.09
MWDJAR34	60		2.51	1.99	0.048	0.020	109		0.77	0.81	8.27		1	70			6.98
MWDJAR34	60		2.51	1.82	0.048	0.019	109		0.77	0.66	8.27		1	80			6.91
MWDJAR34	60		2.51	1.76	0.048	0.027	109		0.77	0.73	8.27		1	90			6.81
MWDJAR34	60		2.51	1.69	0.048	0.023	109		0.77	0.78	8.27		1	100			6.76
MWDJAR34	60		2.51	1.64	0.048	0.022	109		0.77	0.88	8.27		1	110			6.68
MWDJAR34	60		2.51	1.48	0.048	0.035	109		0.77	1.40	8.27		1	120			6.45
MWDJAR34	60		2.51	1.47	0.048	0.036	109		0.77	1.50	8.27		1	130			6.41
MWDJAR35	60		3.44	3.13	0.081	0.077	111		0.74	0.65	8.36		1	0			8.34
MWDJAR35	60		3.44	3.27	0.081	0.054	111		0.74	0.58	8.36		1	10			7.86
MWDJAR35	60		3.44	2.92	0.081	0.044	111		0.74	0.56	8.36		1	20			7.57
MWDJAR35	60		3.44	2.66	0.081	0.038	111		0.74	0.56	8.36		1	30			7.39
MWDJAR35	60		3.44	2.49	0.081	0.036	111		0.74	0.47	8.36		1	40			7.25
MWDJAR35	60		3.44	2.33	0.081	0.031	111		0.74	0.43	8.36		1	50			7.10
MWDJAR35	60		3.44	2.27	0.081	0.043	111		0.74	0.67	8.36		1	60			6.83
MWDJAR35	60		3.44	2.15	0.081	0.034	111		0.74	0.72	8.36		1	70			6.78
MWDJAR35	60		3.44	2.02	0.081	0.028	111		0.74	0.84	8.36		1	80			6.69
MWDJAR35	60		3.44	2.08	0.081	0.028	111		0.74	0.70	8.36		1	90			6.61
MWDJAR35	60		3.44	1.88	0.081	0.026	111		0.74	0.58	8.36		1	100			6.54
MWDJAR35	60		3.44	1.81	0.081	0.028	111		0.74	0.68	8.36		1	110			6.38
MWDJAR35	60		3.44	1.77	0.081	0.028	111		0.74	1.10	8.36		1	120			6.17
MWDJAR35	60		3.44	1.64	0.081	0.027	111		0.74	1.10	8.36		1	130			6.06
MWDJAR35	60		3.44	1.65	0.081	0.031	111		0.74	1.30	8.36		1	140			6.00
MWDJAR35	60		3.44	1.64	0.081	0.028	111		0.74	1.50	8.36		1	150			5.93
MWDJAR36	60		3.22	3.20	0.064	0.063	107		0.43	0.40	8.10		1	0			8.13
MWDJAR36	60		3.22	2.98	0.064	0.051	107		0.43	0.27	8.10		1	10			7.78
MWDJAR36	60		3.22	2.80	0.064	0.047	107		0.43	0.30	8.10		1	20			7.58
MWDJAR36	60		3.22	2.69	0.064	0.044	107		0.43	0.27	8.10		1	30			7.43
MWDJAR36	60		3.22	2.52	0.064	0.040	107		0.43	0.18	8.10		1	40			7.31
MWDJAR36	60		3.22	2.38	0.064	0.038	107		0.43	0.32	8.10		1	50			7.19
MWDJAR36	60		3.22	2.34	0.064	0.037	107		0.43	0.26	8.10		1	60			7.46
MWDJAR36	60		3.22	2.24	0.064	0.035	107		0.43	0.25	8.10		1	70			7.25
MWDJAR36	60		3.22	2.17	0.064	0.034	107		0.43	0.27	8.10		1	80			7.06
MWDJAR36	60		3.22	2.07	0.064	0.033	107		0.43	0.26	8.10		1	90			6.95
MWDJAR36	60		3.22	2.02	0.064	0.030	107		0.43	0.27	8.10		1	100			6.86
MWDJAR36	60		3.22	1.98	0.064	0.037	107		0.43	0.45	8.10		1	110			6.78
MWDJAR36	60		3.22	1.75	0.064	0.026	107		0.43	0.36	8.10		1	120			6.77
MWDJAR36	60		3.22	1.74	0.064	0.026	107		0.43	0.36	8.10		1	130			6.66
MWDJAR36	60		3.22	1.72	0.064	0.027	107		0.43	0.38	8.10		1	140			6.58
MWDJAR36	60		3.22	1.75	0.064	0.026	107		0.43	0.42	8.10		1	150			6.49
MWDJAR36	60		3.22	1.81	0.064	0.025	107		0.43	0.35	8.10		1	160			6.51
MWDJAR36	60		3.22	1.70	0.064	0.039	107		0.43	0.95	8.10		1	170			6.34
MWDJAR36	60		3.22	1.71	0.064	0.037	107		0.43	0.87	8.10		1	180			6.21
MWDJAR36	60		3.22	1.64	0.064	0.050	107		0.43	1.13	8.10		1	190			6.13
MWDJAR37	60		2.56	2.68	0.039	0.038	109		0.88	0.70	8.15		1	0			8.35
MWDJAR37	60		2.56	2.49	0.039	0.036	109		0.88	0.56	8.15		1	10			7.95
MWDJAR37	60		2.56	2.35	0.039	0.030	109		0.88	0.52	8.15		1	20			7.78
MWDJAR37	60		2.56	2.23	0.039	0.026	109		0.88	0.30	8.15		1	30			7.57
MWDJAR37	60		2.56	2.22	0.039	0.024	109		0.88	0.58	8.15		1	40			7.40
MWDJAR37	60		2.56	2.07	0.039	0.023	109		0.88	0.54	8.15		1	50			7.29
MWDJAR37	60		2.56	1.84	0.039	0.021	109		0.88	0.56	8.15		1	60			7.25
MWDJAR37	60		2.56	1.81	0.039	0.019	109		0.88	0.65	8.15		1	70			7.12
MWDJAR37	60		2.56	1.76	0.039	0.017	109		0.88	0.65	8.15		1	80			7.01
MWDJAR37	60		2.56	1.63	0.039	0.015	109		0.88	0.87	8.15		1	90			6.96
MWDJAR37	60		2.56	1.62	0.039	0.016	109		0.88	0.86	8.15		1	100			6.88
MWDJAR37	60		2.56	1.58	0.039	0.015	109		0.88	0.86	8.15		1	110			6.81
MWDJAR37	60		2.56	1.42	0.039	0.018	109		0.88	0.97	8.15		1	120			6.76
MWDJAR37	60		2.56	1.42	0.039	0.017	109		0.88	0.95	8.15		1	130			6.56
MWDJAR37	60		2.56	1.38	0.039	0.015	109		0.88	0.87	8.15		1	140			6.39
MWDJAR37	60		2.56	1.37	0.039	0.015	109		0.88	1.00	8.15		1	150			6.36
MWDJAR37	60		2.56	1.39	0.039	0.015	109		0.88	1.00	8.15		1	160			6.28
MWDJAR37	60		2.56	1.33	0.039	0.014	109		0.88	1.20	8.15		1	170			6.23
MWDJAR38	60		2.49	2.47	0.049	0.049	110		0.84	0.76	8.13		1	0			8.14
MWDJAR38	60		2.49	2.35	0.049	0.035	110		0.84	0.53	8.13		1	10			7.74
MWDJAR38	60		2.49	2.12	0.049	0.027	110		0.84	0.39	8.13		1	20			7.44
MWDJAR38	60		2.49	1.92	0.049	0.023	110		0.84	0.33	8.13		1	30			7.29
MWDJAR38	60		2.49	1.86	0.049	0.020	110		0.84	0.45	8.13		1	40			7.18
MWDJAR38	60		2.49	1.80	0.049	0.020	110		0.84	0.48	8.13		1	50			7.11
MWDJAR38	60		2.49	1.56	0.049	0.020	110		0.84	0.60	8.13		1	60			6.95
MWDJAR38	60		2.49	1.62	0.049	0.018	110		0.84	0.62	8.13		1	70			6.87
MWDJAR38	60		2.49	1.51	0.049	0.017	110		0.84	0.49	8.13		1	80			6.85
MWDJAR38	60		2.49	1.47	0.049	0.017	110		0.84	0.54	8.13		1	90			6.79
MWDJAR38	60		2.49	1.38	0.049	0.014	110		0.84	0.84	8.13		1	100			6.71
MWDJAR38	60		2.49	1.39	0.049	0.014	110		0.84	0.83	8.13		1	110			6.59
MWDJAR38	60		2.49	1.34	0.049	0.020	110		0.84	0.97	8.13		1	120			6.53
MWDJAR38	60		2.49	1.35	0.049	0.021	110		0.84	0.95	8.13		1	130			6.48
MWDJAR38	60		2.49	1.34	0.049	0.020	110		0.84	1.10	8.13		1	140			6.39
MWDJAR38	60		2.49	1.29	0.049	0.019	110		0.84	1.20	8.13		1	150			6.33
MWDJAR38	60		2.49	1.31	0.049	0.018	110		0.84	1.20	8.13		1	160			6.21

Study ID	Water % CRW	Water % SPW	TOC (mg/L) Raw	TOC (mg/L) Filt.	UV-254 (1/cm) Raw	UV-254 (1/cm) Filt.	Alkalinity (mg/L as CaCO3) Raw	Alkalinity (mg/L as CaCO3) Filt.	Turbidity (NTU) Raw	Turbidity (NTU) Filt.	pH () Raw	pH () Filt.	Coagulation Conditions: Coagulant ID (see above)	Dose	Acid adjusted? (Y/N) blank=N	Base adjusted? (Y/N) blank=N	Coag. pH ()
MWDJAR39	60		2.68	2.69	0.059	0.057	109		0.48	0.45	8.26		1	0			8.22
MWDJAR39	60		2.68	2.48	0.059	0.042	109		0.48	0.51	8.26		1	10			7.87
MWDJAR39	60		2.68	2.31	0.059	0.039	109		0.48	0.37	8.26		1	20			7.65
MWDJAR39	60		2.68	2.15	0.059	0.035	109		0.48	0.32	8.26		1	30			7.52
MWDJAR39	60		2.68	1.98	0.059	0.031	109		0.48	0.38	8.26		1	40			7.36
MWDJAR39	60		2.68	1.87	0.059	0.030	109		0.48	0.37	8.26		1	50			7.29
MWDJAR39	60		2.68	1.80	0.059	0.026	109		0.48	0.42	8.26		1	60			7.12
MWDJAR39	60		2.68	1.74	0.059	0.026	109		0.48	0.54	8.26		1	70			7.02
MWDJAR39	60		2.68	1.66	0.059	0.025	109		0.48	0.48	8.26		1	80			6.95
MWDJAR39	60		2.68	1.61	0.059	0.023	109		0.48	0.58	8.26		1	90			6.88
MWDJAR39	60		2.68	1.60	0.059	0.022	109		0.48	0.68	8.26		1	100			6.79
MWDJAR39	60		2.68	1.60	0.059	0.025	109		0.48	0.77	8.26		1	110			6.83
MWDJAR39	60		2.68	1.50	0.059	0.023	109		0.48	0.76	8.26		1	120			6.75
MWDJAR39	60		2.68	1.57	0.059	0.023	109		0.48	1.00	8.26		1	130			6.62
MWDJAR39	60		2.68	1.43	0.059	0.021	109		0.48	0.80	8.26		1	140			6.42
MWDJAR39	60		2.68	1.41	0.059	0.021	109		0.48	0.92	8.26		1	150			6.38
MWDJAR39	60		2.68	1.34	0.059	0.021	109		0.48	0.92	8.26		1	160			6.27
MWDJAR4	100		2.55	2.67	0.043	0.040	123		0.85	0.20	8.23		1	0			8.08
MWDJAR4	100		2.55	2.68	0.043	0.038	123		0.85	0.40	8.23		1	10			7.85
MWDJAR4	100		2.55	2.54	0.043	0.034	123		0.85	0.30	8.23		1	20			7.60
MWDJAR4	100		2.55	2.44	0.043	0.031	123		0.85	0.26	8.23		1	30			7.49
MWDJAR4	100		2.55	2.31	0.043	0.029	123		0.85	0.21	8.23		1	40			7.37
MWDJAR4	100		2.55	2.26	0.043	0.029	123		0.85	0.33	8.23		1	50			7.27
MWDJAR4	100		2.55	2.09	0.043	0.027	123		0.85	0.21	8.23		1	60			7.21
MWDJAR4	100		2.55	2.04	0.043	0.030	123		0.85	0.22	8.23		1	70			7.05
MWDJAR4	100		2.55	1.95	0.043	0.026	123		0.85	0.25	8.23		1	80			6.97
MWDJAR4	100		2.55	1.92	0.043	0.027	123		0.85	0.31	8.23		1	90			6.91
MWDJAR4	100		2.55	1.84	0.043	0.025	123		0.85	0.25	8.23		1	100			6.82
MWDJAR4	100		2.55	1.85	0.043	0.027	123		0.85	0.55	8.23		1	110			6.75
MWDJAR40	60		2.57	2.53	0.042	0.046	101		3.10	0.52	8.05		1	0			8.03
MWDJAR40	60		2.57	2.41	0.042	0.042	101		3.10	0.33	8.05		1	10			7.85
MWDJAR40	60		2.57	3.35	0.042	0.035	101		3.10	0.34	8.05		1	20			7.68
MWDJAR40	60		2.57	2.16	0.042	0.032	101		3.10	0.24	8.05		1	30			7.54
MWDJAR40	60		2.57	2.04	0.042	0.030	101		3.10	0.27	8.05		1	40			7.33
MWDJAR40	60		2.57	1.80	0.042	0.028	101		3.10	0.24	8.05		1	50			7.26
MWDJAR40	60		2.57	1.76	0.042	0.026	101		3.10	0.20	8.05		1	60			7.13
MWDJAR40	60		2.57	1.66	0.042	0.024	101		3.10	0.32	8.05		1	70			7.02
MWDJAR40	60		2.57	1.66	0.042	0.022	101		3.10	0.38	8.05		1	80			6.96
MWDJAR40	60		2.57	1.59	0.042	0.021	101		3.10	0.33	8.05		1	90			6.89
MWDJAR40	60		2.57	1.57	0.042	0.021	101		3.10	0.38	8.05		1	100			6.75
MWDJAR40	60		2.57	1.49	0.042	0.022	101		3.10	0.45	8.05		1	110			6.74
MWDJAR40	60		2.57	1.48	0.042	0.021	101		3.10	0.54	8.05		1	120			6.70
MWDJAR40	60		2.57	1.47	0.042	0.020	101		3.10	0.61	8.05		1	130			6.65
MWDJAR40	60		2.57	1.39	0.042	0.019	101		3.10	0.69	8.05		1	140			6.54
MWDJAR40	60		2.57	1.39	0.042	0.019	101		3.10	0.70	8.05		1	150			6.46
MWDJAR40	60		2.57	1.36	0.042	0.018	101		3.10	0.75	8.05		1	160			6.39
MWDJAR40	60		2.57	1.53	0.042	0.017	101		3.10	0.80	8.05		1	170			6.30
MWDJAR40	60		2.57	1.61	0.042	0.017	101		3.10	1.20	8.05		1	180			6.19
MWDJAR40	60		2.57	1.50	0.042	0.016	101		3.10	1.20	8.05		1	190			6.13
MWDJAR41	50		2.64	2.78	0.079		94		0.85		8.13		1	0			7.98
MWDJAR41	50		2.64	2.69	0.079	0.065	94		0.85	0.56	8.13		1	10			7.47
MWDJAR41	50		2.64	2.50	0.079	0.058	94		0.85	0.65	8.13		1	20			7.25
MWDJAR41	50		2.64	2.40	0.079		94		0.85	0.50	8.13		1	30			7.05
MWDJAR41	50		2.64	2.23	0.079	0.040	94		0.85	0.50	8.13		1	40			6.93
MWDJAR41	50		2.64	2.13	0.079	0.041	94		0.85	0.70	8.13		1	50			6.82
MWDJAR41	50		2.64	2.15	0.079	0.040	94		0.85	0.58	8.13		1	60			6.73
MWDJAR41	50		2.64	1.97	0.079	0.031	94		0.85	0.80	8.13		1	70			6.61
MWDJAR41	50		2.64	1.96	0.079	0.031	94		0.85	1.00	8.13		1	80			6.44
MWDJAR41	50		2.64	1.85	0.079	0.030	94		0.85	0.98	8.13		1	90			6.19
MWDJAR42	50		2.37	2.52	0.061	0.054	103		0.75	0.78	8.17		1	0			8.15
MWDJAR42	50		2.37	2.32	0.061	0.034	103		0.75	0.57	8.17		1	10			7.49
MWDJAR42	50		2.37	2.19	0.061	0.031	103		0.75	0.68	8.17		1	20			7.32
MWDJAR42	50		2.37	2.00	0.061	0.027	103		0.75	0.51	8.17		1	30			7.12
MWDJAR42	50		2.37	1.91	0.061	0.025	103		0.75	0.86	8.17		1	40			7.03
MWDJAR42	50		2.37	1.79	0.061	0.028	103		0.75	0.85	8.17		1	50			6.88
MWDJAR42	50		2.37	1.77	0.061	0.024	103		0.75	1.10	8.17		1	60			6.69
MWDJAR42	50		2.37	1.83	0.061	0.028	103		0.75	1.30	8.17		1	70			6.60
MWDJAR42	50		2.37	1.80	0.061	0.028	103		0.75	1.50	8.17		1	80			6.51
MWDJAR42	50		2.37	1.66	0.061	0.024	103		0.75	1.40	8.17		1	90			6.49
MWDJAR42	50		2.37	1.72	0.061	0.026	103		0.75	1.50	8.17		1	100			6.41
MWDJAR42	50		2.37	1.58	0.061	0.028	103		0.75	1.50	8.17		1	110			6.26
MWDJAR43	50		3.18	3.41	0.081	0.079	106		0.87	0.74	8.32		1	0			8.37
MWDJAR43	50		3.18	3.03	0.081	0.058	106		0.87	0.86	8.32		1	10			7.88
MWDJAR43	50		3.18	2.78	0.081	0.046	106		0.87	0.72	8.32		1	20			7.58
MWDJAR43	50		3.18	2.50	0.081	0.039	106		0.87	0.66	8.32		1	30			7.36
MWDJAR43	50		3.18	2.26	0.081	0.036	106		0.87	0.51	8.32		1	40			7.22
MWDJAR43	50		3.18	2.29	0.081	0.036	106		0.87	0.51	8.32		1	50			7.13
MWDJAR43	50		3.18	2.28	0.081	0.038	106		0.87	0.61	8.32		1	60			6.71
MWDJAR43	50		3.18	2.10	0.081	0.036	106		0.87	0.67	8.32		1	70			6.70
MWDJAR43	50		3.18	2.02	0.081	0.032	106		0.87	0.76	8.32		1	80			6.58
MWDJAR43	50		3.18	2.08	0.081	0.034	106		0.87	0.73	8.32		1	90			6.54
MWDJAR43	50		3.18	2.05	0.081	0.032	106		0.87	0.76	8.32		1	100			6.49
MWDJAR43	50		3.18	2.07	0.081	0.030	106		0.87	1.20	8.32		1	110			6.33
MWDJAR43	50		3.18	1.92	0.081	0.030	106		0.87	1.10	8.32		1	120			6.24
MWDJAR43	50		3.18	2.11	0.081	0.027	106		0.87	1.40	8.32		1	130			6.13
MWDJAR43	50		3.18	1.77	0.081	0.026	106		0.87	2.00	8.32		1	140			5.99
MWDJAR43	50		3.18	2.02	0.081	0.025	106		0.87	1.40	8.32		1	150			5.93
MWDJAR44	50		3.11	3.17	0.066	0.070	103		1.30	0.51	7.99		1	0			8.14
MWDJAR44	50		3.11	2.20	0.066	0.049	103		1.30	0.28	7.99		1	10			7.76
MWDJAR44	50		3.11	2.78	0.066	0.045	103		1.30	0.27	7.99		1	20			7.50
MWDJAR44	50		3.11	2.64	0.066	0.041	103		1.30	0.24	7.99		1	30			7.36
MWDJAR44	50		3.11	2.42	0.066	0.036	103		1.30	0.25	7.99		1	40			7.20

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Study ID	Water		TOC		UV-254		Alkalinity		Turbidity		pH		Coagulation Conditions				
	% CRW	% SPW	(mg/L)		(1/cm)		(mg/L as CaCO3)		(NTU)		()		Coagulant	Dose	Acid	Base	Coag.
			Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	ID		adjusted?	adjusted?	pH
													(see above)		(Y/N)	(Y/N)	()
															blank=N	blank=N	
MWDJAR44	50		3.11	2.32	0.066	0.035	103		1.30	0.21	7.99		1	50			7.14
MWDJAR44	50		3.11	2.25	0.066	0.032	103		1.30	0.19	7.99		1	60			7.07
MWDJAR44	50		3.11	3.04	0.066	0.033	103		1.30	0.25	7.99		1	70			6.93
MWDJAR44	50		3.11	2.07	0.066	0.033	103		1.30	0.29	7.99		1	80			6.87
MWDJAR44	50		3.11	2.02	0.066	0.030	103		1.30	0.33	7.99		1	90			6.78
MWDJAR44	50		3.11	1.97	0.066	0.028	103		1.30	0.35	7.99		1	100			6.68
MWDJAR44	50		3.11	1.85	0.066	0.027	103		1.30	0.28	7.99		1	110			6.65
MWDJAR44	50		3.11	1.83	0.066	0.030	103		1.30	0.46	7.99		1	120			6.52
MWDJAR44	50		3.11	1.83	0.066	0.030	103		1.30	0.56	7.99		1	130			6.51
MWDJAR44	50		3.11	1.78	0.066	0.028	103		1.30	0.52	7.99		1	140			6.44
MWDJAR44	50		3.11	1.69	0.066	0.028	103		1.30	0.44	7.99		1	150			6.34
MWDJAR44	50		3.11	1.66	0.066	0.030	103		1.30	0.45	7.99		1	160			6.34
MWDJAR45	50		2.46	2.63		0.061	105		0.87	0.78	8.14		1	0			8.27
MWDJAR45	50		2.46	2.30		0.047	105		0.87	0.55	8.14		1	10			7.91
MWDJAR45	50		2.46	2.26		0.042	105		0.87	0.50	8.14		1	20			7.52
MWDJAR45	50		2.46	2.07		0.036	105		0.87	0.52	8.14		1	30			7.55
MWDJAR45	50		2.46	1.96		0.034	105		0.87	0.33	8.14		1	40			7.31
MWDJAR45	50		2.46	1.84		0.032	105		0.87	0.40	8.14		1	50			7.26
MWDJAR45	50		2.46	1.82		0.029	105		0.87	0.52	8.14		1	60			7.16
MWDJAR45	50		2.46	1.72		0.028	105		0.87	0.44	8.14		1	70			7.12
MWDJAR45	50		2.46	1.76		0.027	105		0.87	0.62	8.14		1	80			7.02
MWDJAR45	50		2.46	1.69		0.026	105		0.87	0.64	8.14		1	90			6.80
MWDJAR45	50		2.46	1.59		0.025	105		0.87	0.72	8.14		1	100			6.76
MWDJAR45	50		2.46	1.56		0.024	105		0.87	0.94	8.14		1	110			6.71
MWDJAR45	50		2.46	1.52		0.023	105		0.87	0.65	8.14		1	120			6.62
MWDJAR45	50		2.46	1.46		0.022	105		0.87	0.80	8.14		1	130			6.50
MWDJAR45	50		2.46	1.45		0.021	105		0.87	1.00	8.14		1	140			6.48
MWDJAR45	50		2.46	1.48		0.016	105		0.87	1.10	8.14		1	150			6.52
MWDJAR45	50		2.46	1.38		0.015	105		0.87	1.20	8.14		1	160			6.39
MWDJAR45	50		2.46	1.36		0.014	105		0.87	1.30	8.14		1	170			6.27
MWDJAR45	50		2.46	1.31		0.015	105		0.87	1.50	8.14		1	180			6.18
MWDJAR46	50		2.46	2.56	0.040	0.040	105		0.73	0.60	8.13		1	0			8.20
MWDJAR46	50		2.46	2.54	0.040	0.028	105		0.73	0.70	8.13		1	10			7.86
MWDJAR46	50		2.46	2.43	0.040	0.019	105		0.73	0.44	8.13		1	20			7.63
MWDJAR46	50		2.46	2.13	0.040	0.013	105		0.73	0.29	8.13		1	30			7.45
MWDJAR46	50		2.46	2.05	0.040	0.011	105		0.73	0.52	8.13		1	40			7.31
MWDJAR46	50		2.46	2.00	0.040	0.010	105		0.73	0.67	8.13		1	50			7.19
MWDJAR46	50		2.46	1.86	0.040	0.010	105		0.73	0.66	8.13		1	60			7.17
MWDJAR46	50		2.46	1.73	0.040	0.010	105		0.73	0.71	8.13		1	70			7.04
MWDJAR46	50		2.46	1.75	0.040	0.010	105		0.73	0.83	8.13		1	80			6.93
MWDJAR46	50		2.46	1.62	0.040	0.007	105		0.73	0.75	8.13		1	90			6.84
MWDJAR46	50		2.46	1.59	0.040	0.004	105		0.73	0.95	8.13		1	100			6.75
MWDJAR46	50		2.46	1.59	0.040	0.004	105		0.73	1.50	8.13		1	110			6.66
MWDJAR46	50		2.46	1.26	0.040	0.023	105		0.73	1.00	8.13		1	120			6.50
MWDJAR46	50		2.46	1.32	0.040	0.019	105		0.73	1.10	8.13		1	130			6.46
MWDJAR46	50		2.46	1.18	0.040	0.017	105		0.73	0.25	8.13		1	140			6.31
MWDJAR46	50		2.46	1.17	0.040	0.016	105		0.73	1.10	8.13		1	150			6.27
MWDJAR46	50		2.46	1.15	0.040	0.021	105		0.73	1.30	8.13		1	160			6.15
MWDJAR47	50		2.79	2.79	0.063	0.062	102		0.42	0.40	8.23		1	0			8.27
MWDJAR47	50		2.79	2.70	0.063	0.049	102		0.42	0.50	8.23		1	10			7.85
MWDJAR47	50		2.79	2.39	0.063	0.041	102		0.42	0.48	8.23		1	20			7.56
MWDJAR47	50		2.79	2.20	0.063	0.036	102		0.42	0.39	8.23		1	30			7.38
MWDJAR47	50		2.79	2.15	0.063	0.032	102		0.42	0.42	8.23		1	40			7.23
MWDJAR47	50		2.79	1.94	0.063	0.028	102		0.42	0.45	8.23		1	50			7.18
MWDJAR47	50		2.79	1.84	0.063	0.026	102		0.42	0.50	8.23		1	60			7.13
MWDJAR47	50		2.79	1.76	0.063	0.025	102		0.42	0.50	8.23		1	70			7.03
MWDJAR47	50		2.79	1.69	0.063	0.024	102		0.42	0.43	8.23		1	80			6.92
MWDJAR47	50		2.79	1.60	0.063	0.024	102		0.42	0.54	8.23		1	90			6.87
MWDJAR47	50		2.79	1.58	0.063	0.022	102		0.42	0.58	8.23		1	100			6.77
MWDJAR47	50		2.79	1.61	0.063	0.023	102		0.42	0.68	8.23		1	110			6.61
MWDJAR47	50		2.79	1.53	0.063	0.021	102		0.42	0.84	8.23		1	120			6.46
MWDJAR47	50		2.79	1.50	0.063	0.021	102		0.42	0.82	8.23		1	130			6.38
MWDJAR47	50		2.79	1.49	0.063	0.020	102		0.42	0.86	8.23		1	140			6.34
MWDJAR47	50		2.79	1.44	0.063	0.019	102		0.42	0.90	8.23		1	150			6.20
MWDJAR47	50		2.79	1.45	0.063	0.020	102		0.42	1.30	8.23		1	160			6.11
MWDJAR48		100	3.31	3.31	0.126		73		2.40	1.30	7.91		1	0			7.87
MWDJAR48		100	3.31	3.21	0.126	0.103	73		2.40	0.88	7.91		1	10			7.57
MWDJAR48		100	3.31	3.05	0.126	0.081	73		2.40	0.53	7.91		1	20			7.32
MWDJAR48		100	3.31	2.68	0.126	0.066	73		2.40	0.54	7.91		1	30			7.14
MWDJAR48		100	3.31	2.36	0.126	0.061	73		2.40	0.52	7.91		1	40			6.83
MWDJAR48		100	3.31	2.22	0.126	0.054	73		2.40	0.45	7.91		1	50			6.79
MWDJAR48		100	3.31	2.12	0.126	0.049	73		2.40	0.50	7.91		1	60			6.64
MWDJAR48		100	3.31	1.89	0.126	0.049	73		2.40	0.95	7.91		1	70			6.15
MWDJAR48		100	3.31	1.83	0.126	0.050	73		2.40	0.83	7.91		1	80			6.09
MWDJAR48		100	3.31	1.78	0.126	0.049	73		2.40	1.10	7.91		1	90			5.80
MWDJAR48	50		2.55	2.55	0.057	0.057	94		0.34	0.36	7.93		1	0			7.95
MWDJAR48	50		2.55	2.32	0.057	0.051	94		0.34	0.17	7.93		1	10			7.86
MWDJAR48	50		2.55	2.20	0.057	0.045	94		0.34	0.17	7.93		1	20			7.71
MWDJAR48	50		2.55	2.14	0.057	0.041	94		0.34	0.19	7.93		1	30			7.59
MWDJAR48	50		2.55	1.97	0.057	0.033	94		0.34	0.20	7.93		1	40			7.48
MWDJAR48	50		2.55	1.86	0.057	0.032	94		0.34	0.20	7.93		1	50			7.39
MWDJAR48	50		2.55	1.74	0.057	0.030	94		0.34	0.20	7.93		1	60			7.34
MWDJAR48	50		2.55	1.68	0.057	0.028	94		0.34	0.19	7.93		1	70			7.27
MWDJAR48	50		2.55	1.67	0.057	0.026	94		0.34	0.20	7.93		1	80			7.15
MWDJAR48	50		2.55	1.61	0.057	0.024	94		0.34	0.22	7.93		1	90			7.13
MWDJAR48	50		2.55	1.49	0.057	0.023	94		0.34	0.40	7.93		1	100			7.02
MWDJAR48	50		2.55	1.55	0.057	0.023	94		0.34	0.38	7.93		1	110			6.95
MWDJAR48	50		2.55	1.58	0.057	0.022	94		0.34	0.42	7.93		1	120			6.80
MWDJAR48	50		2.55	1.56	0.057	0.021	94		0.34	0.42	7.93		1	130			6.63
MWDJAR48	50		2.55	1.49	0.057	0.020	94		0.34	0.44	7.93		1	140			6.55
MWDJAR48	50		2.55	1.47	0.057	0.020	94		0.34	0.70	7.93		1	150			6.44
MWDJAR48	50		2.55	1.41	0.057	0.024	94		0.34	1.20	7.93		1	160			6.32

C-031065

Study ID	Water % CRW	Water % SPW	TOC (mg/L) Raw	TOC (mg/L) Filt.	UV-254 (1/cm) Raw	UV-254 (1/cm) Filt.	Alkalinity (mg/L as CaCO3) Raw	Alkalinity (mg/L as CaCO3) Filt.	Turbidity (NTU) Raw	Turbidity (NTU) Filt.	pH () Raw	pH () Filt.	Coagulation Conditions: Coagulant ID (see above)	Dose	Acid adjusted? (Y/N) blank=N	Base adjusted? (Y/N) blank=N	Coag. pH ()
MWDJAR49		100	2.33	2.36	0.077	0.074	73			0.85	8.07		1	0			8.07
MWDJAR49		100	2.33	2.20	0.077	0.064	73			0.57	8.07		1	10			7.65
MWDJAR49		100	2.33	2.19	0.077	0.050	73			0.75	8.07		1	20			7.41
MWDJAR49		100	2.33	2.03	0.077	0.046	73			0.56	8.07		1	30			7.24
MWDJAR49		100	2.33	1.84	0.077	0.043	73			0.72	8.07		1	40			7.15
MWDJAR49		100	2.33	1.75	0.077	0.040	73			0.75	8.07		1	50			7.05
MWDJAR49		100	2.33	1.72	0.077	0.040	73			0.53	8.07		1	60			7.00
MWDJAR49		100	2.33	1.78	0.077	0.037	73			0.47	8.07		1	70			6.87
MWDJAR49		100	2.33	1.42	0.077	0.035	73			0.47	8.07		1	80			6.73
MWDJAR49		100	2.33	1.41	0.077	0.035	73			0.57	8.07		1	90			6.66
MWDJAR49		100	2.33	1.54	0.077	0.030	73			0.56	8.07		1	100			6.58
MWDJAR49		100	2.33	1.31	0.077	0.028	73			0.60	8.07		1	110			6.45
MWDJAR49		100	2.33	1.30	0.077	0.031	73			0.45	8.07		1	120			6.38
MWDJAR49		100	2.33	1.25	0.077	0.029	73			0.60	8.07		1	130			6.23
MWDJAR49		100	2.33	1.20	0.077	0.028	73			0.65	8.07		1	140			6.14
MWDJAR5	100		2.37	2.40	0.048	0.048	131		0.76	0.58	8.23		1	0			8.23
MWDJAR5	100		2.37	2.27	0.048	0.043	131		0.76	0.57	8.23		1	10			7.88
MWDJAR5	100		2.37	2.19	0.048	0.038	131		0.76	0.47	8.23		1	20			7.77
MWDJAR5	100		2.37	2.32	0.048	0.036	131		0.76	0.59	8.23		1	30			7.66
MWDJAR5	100		2.37	2.07	0.048	0.033	131		0.76	0.61	8.23		1	40			7.52
MWDJAR5	100		2.37	1.96	0.048	0.029	131		0.76	0.46	8.23		1	50			7.44
MWDJAR5	100		2.37	1.94	0.048	0.028	131		0.76	0.78	8.23		1	60			7.36
MWDJAR5	100		2.37	1.84	0.048	0.026	131		0.76	0.77	8.23		1	70			7.25
MWDJAR5	100		2.37	1.77	0.048	0.025	131		0.76	0.82	8.23		1	80			7.16
MWDJAR5	100		2.37	1.75	0.048	0.024	131		0.76	0.85	8.23		1	90			7.05
MWDJAR5	100		2.37	1.68	0.048	0.015	131		0.76	0.86	8.23		1	100			7.06
MWDJAR5	100		2.37	1.65	0.048	0.015	131		0.76	1.30	8.23		1	110			6.97
MWDJAR50		100	3.90	4.45	0.110	0.109	77		1.7	1.50	8.00		1	0			8.00
MWDJAR50		100	3.90	3.69	0.110	0.072	77		1.7	0.79	8.00		1	10			7.44
MWDJAR50		100	3.90	3.17	0.110	0.049	77		1.7	0.39	8.00		1	20			7.15
MWDJAR50		100	3.90	2.81	0.110	0.037	77		1.7	0.38	8.00		1	30			6.99
MWDJAR50		100	3.90	2.38	0.110	0.032	77		1.7	0.31	8.00		1	40			6.92
MWDJAR50		100	3.90	2.25	0.110	0.029	77		1.7	0.66	8.00		1	50			6.89
MWDJAR50		100	3.90	2.16	0.110	0.024	77		1.7	0.60	8.00		1	60			6.66
MWDJAR50		100	3.90	2.06	0.110	0.020	77		1.7	0.58	8.00		1	70			6.45
MWDJAR50		100	3.90	1.99	0.110	0.020	77		1.7	0.65	8.00		1	80			6.31
MWDJAR50		100	3.90	2.00	0.110	0.021	77		1.7	0.67	8.00		1	90			6.14
MWDJAR50		100	3.90	2.03	0.110	0.018	77		1.7	1.10	8.00		1	100			5.93
MWDJAR50		100	3.90	1.80	0.110	0.020	77		1.7	0.90	8.00		1	110			5.70
MWDJAR51		100	3.09	3.17	0.097	0.103	81		0.85	2.30	7.80		1	0			7.86
MWDJAR51		100	3.09	2.94	0.097	0.077	81		0.85	0.33	7.80		1	10			7.58
MWDJAR51		100	3.09	3.28	0.097	0.072	81		0.85	0.36	7.80		1	20			7.38
MWDJAR51		100	3.09	2.97	0.097	0.066	81		0.85	0.40	7.80		1	30			7.14
MWDJAR51		100	3.09	2.42	0.097	0.054	81		0.85	0.29	7.80		1	40			7.06
MWDJAR51		100	3.09	2.23	0.097	0.049	81		0.85	0.45	7.80		1	50			7.00
MWDJAR51		100	3.09	2.55	0.097	0.051	81		0.85	0.30	7.80		1	60			6.97
MWDJAR51		100	3.09	2.32	0.097	0.044	81		0.85	0.36	7.80		1	70			6.77
MWDJAR51		100	3.09	2.31	0.097	0.040	81		0.85	0.31	7.80		1	80			6.66
MWDJAR51		100	3.09	2.33	0.097	0.039	81		0.85	0.38	7.80		1	90			6.57
MWDJAR51		100	3.09	2.08	0.097	0.036	81		0.85	0.32	7.80		1	100			6.43
MWDJAR51		100	3.09	1.94	0.097	0.040	81		0.85	0.62	7.80		1	110			6.35
MWDJAR51		100	3.09	1.74	0.097	0.038	81		0.85	0.35	7.80		1	120			6.23
MWDJAR51		100	3.09	1.91	0.097	0.035	81		0.85	0.30	7.80		1	130			6.25
MWDJAR52		100	2.78	2.94		0.080			0.78	0.77	7.72		1	0			7.91
MWDJAR52		100	2.78	2.88		0.061			0.78	0.40	7.72		1	10			7.70
MWDJAR52		100	2.78	2.40		0.051			0.78	0.36	7.72		1	20			7.33
MWDJAR52		100	2.78	2.09		0.048			0.78	0.31	7.72		1	30			7.14
MWDJAR52		100	2.78	1.95		0.040			0.78	0.33	7.72		1	40			7.11
MWDJAR52		100	2.78	1.88		0.034			0.78	0.32	7.72		1	50			6.92
MWDJAR52		100	2.78	1.75		0.031			0.78	0.37	7.72		1	60			6.88
MWDJAR52		100	2.78	1.64		0.028			0.78	0.47	7.72		1	70			6.84
MWDJAR52		100	2.78	1.52		0.026			0.78	0.64	7.72		1	80			6.71
MWDJAR52		100	2.78	1.49		0.025			0.78	0.50	7.72		1	90			6.65
MWDJAR52		100	2.78	1.47		0.025			0.78	0.54	7.72		1	100			6.58
MWDJAR52		100	2.78	1.43		0.024			0.78	0.50	7.72		1	110			6.45
MWDJAR52		100	2.78	1.36		0.023			0.78	0.52	7.72		1	120			6.34
MWDJAR52		100	2.78	1.29		0.023			0.78	0.65	7.72		1	130			6.25
MWDJAR52		100	2.78	1.34		0.024			0.78	1.00	7.72		1	140			6.07
MWDJAR53		100	2.25	2.40	0.065	0.066	79		1.10	0.88	7.98		1	0			7.98
MWDJAR53		100	2.25	2.24	0.065	0.046	79		1.10	0.48	7.98		1	10			7.58
MWDJAR53		100	2.25	1.98	0.065	0.031	79		1.10	0.40	7.98		1	20			7.33
MWDJAR53		100	2.25	2.06	0.065	0.021	79		1.10	0.38	7.98		1	30			7.13
MWDJAR53		100	2.25	1.59	0.065	0.017	79		1.10	0.42	7.98		1	40			7.07
MWDJAR53		100	2.25	1.75	0.065	0.016	79		1.10	0.46	7.98		1	50			6.97
MWDJAR53		100	2.25	1.45	0.065	0.013	79		1.10	0.59	7.98		1	60			6.69
MWDJAR53		100	2.25	1.38	0.065	0.009	79		1.10	0.74	7.98		1	70			6.61
MWDJAR53		100	2.25	1.29	0.065	0.008	79		1.10	0.69	7.98		1	80			6.54
MWDJAR53		100	2.25	1.43	0.065	0.007	79		1.10	0.69	7.98		1	90			6.46
MWDJAR53		100	2.25	1.21	0.065	0.006	79		1.10	0.90	7.98		1	100			6.33
MWDJAR53		100	2.25	1.19	0.065	0.006	79		1.10	0.90	7.98		1	110			6.29
MWDJAR54		100	2.92	3.21	0.087	0.091	72		0.52	0.55	7.87		1	0			7.90
MWDJAR54		100	2.92	2.91	0.087	0.070	72		0.52	0.70	7.87		1	10			7.64
MWDJAR54		100	2.92	2.33	0.087	0.051	72		0.52	0.59	7.87		1	20			7.54
MWDJAR54		100	2.92	2.55	0.087	0.043	72		0.52	0.52	7.87		1	30			7.35
MWDJAR54		100	2.92	2.05	0.087	0.039	72		0.52	0.47	7.87		1	40			7.15
MWDJAR54		100	2.92	1.91	0.087	0.037	72		0.52	0.45	7.87		1	50			7.11
MWDJAR54		100	2.92	1.63	0.087	0.030	72		0.52	0.52	7.87		1	60			6.87
MWDJAR54		100	2.92	1.49	0.087	0.025	72		0.52	0.49	7.87		1	70			6.85
MWDJAR54		100	2.92	1.55	0.087	0.022	72		0.52	0.45	7.87		1	80			6.72
MWDJAR54		100	2.92	1.42	0.087	0.018	72		0.52	0.57	7.87		1	90			6.55
MWDJAR54		100	2.92	1.44	0.087	0.015	72		0.52	0.64	7.87		1	100			6.49
MWDJAR54		100	2.92	1.38	0.087	0.014	72		0.52	0.56	7.87		1	110			6.37

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Study ID	Water		TOC		UV-254		Alkalinity		Turbidity		pH		Coagulation Conditions				
	% CRW	% SPW	(mg/L)		(1/cm)		(mg/L as CaCO3)		(NTU)		()		Coagulant	Dose	Acid	Base	Coag.
			Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	ID		adjusted?	adjusted?	pH
													(see above)		(Y/N)	(Y/N)	()
															blank=N	blank=N	
MWDJARS4		100	2.92	1.30	0.087	0.014	72		0.52	0.62	7.87		1	120			6.12
MWDJARS4		100	2.92	1.27	0.087	0.013	72		0.52	0.68	7.87		1	130			6.08
MWDJARS4		100	2.92	1.22	0.087	0.014	72		0.52	0.81	7.87		1	140			5.93
MWDJARS4		100	2.92	1.25	0.087	0.014	72		0.52	0.98	7.87		1	150			5.69
MWDJARS4		100	2.92	1.23	0.087	0.021	72		0.52	1.30	7.87		1	160			5.51
MWDJARS5		100	2.68	2.65	0.086	0.083	62		0.72	0.55	7.82		1	0			7.77
MWDJARS5		100	2.68	2.43	0.086	0.061	62		0.72	0.42	7.82		1	10			7.52
MWDJARS5		100	2.68	2.24	0.086	0.051	62		0.72	0.74	7.82		1	20			7.35
MWDJARS5		100	2.68	2.00	0.086	0.040	62		0.72	0.24	7.82		1	30			7.18
MWDJARS5		100	2.68	1.76	0.086	0.036	62		0.72	0.29	7.82		1	40			7.12
MWDJARS5		100	2.68	1.76	0.086	0.032	62		0.72	0.30	7.82		1	50			7.20
MWDJARS5		100	2.68	1.58	0.086	0.030	62		0.72	0.28	7.82		1	60			7.08
MWDJARS5		100	2.68	1.40	0.086	0.029	62		0.72	0.24	7.82		1	70			6.97
MWDJARS5		100	2.68	1.45	0.086	0.027	62		0.72	0.25	7.82		1	80			6.84
MWDJARS5		100	2.68	1.40	0.086	0.024	62		0.72	0.31	7.82		1	90			6.67
MWDJARS5		100	2.68	1.34	0.086	0.023	62		0.72	0.25	7.82		1	100			6.50
MWDJARS5		100	2.68	1.47	0.086	0.024	62		0.72	0.74	7.82		1	110			6.45
MWDJARS5		100	2.68	1.31	0.086	0.024	62		0.72	0.44	7.82		1	120			6.20
MWDJARS5		100	2.68	1.34	0.086	0.021	62		0.72	0.63	7.82		1	130			5.95
MWDJARS5		100	2.68	1.33	0.086	0.022	62		0.72	0.50	7.82		1	140			5.83
MWDJARS5		100	2.68	1.30	0.086	0.022	62		0.72	0.72	7.82		1	150			5.52
MWDJARS5		100	2.68	1.32	0.086	0.021	62		0.72	0.72	7.82		1	160			5.30

Study ID				Disinfection By-products				Coagulation Conditions					
	ered			TTHM		HAA5		Coagulant	Dose	Acid	Base	Coag.	Coag.
	mmoni	bubation t	Residual	(µg/L)		(µg/L)		ID		adjusted?	adjusted?	pH	temp.
	dose	(h)		Raw	Filt.	Raw	Filt.	(see above)		(Y/N)	(Y/N)	()	(deg. C)
	g NH3-N	chlorine	(mg Cl2/L)										
MWDOP4					67.4		29.4	1	20	Y		7.17	
MWDOP4					62.7		< 28.9	1	20	Y		7.11	
MWDOP4					54.9		< 22.3	1	20	Y		6.34	
MWDOP4					49.9		21.0	1	20	Y		6 40	
MWDOP4					53.1		20.9	1	20	Y		5.52	
MWDOP4					52.2		22.4	1	20	Y		5.71	
MWDOP4					62.1		23.8	1	30	Y		7.26	
MWDOP4					63.5		<24.7	1	30	Y		7.05	
MWDOP4					53.0		< 21.1	1	30	Y		6.26	
MWDOP4					53.8		<20.3	1	30	Y		6.50	
MWDOP4					48.1		<17.8	1	30	Y		6.23	
MWDOP4					46.7		<21.5	1	30	Y		5.43	
MWDOP4					56.4		24.9	1	40	Y		6.97	
MWDOP4					57.1		25.3	1	40	Y		7.24	
MWDOP4					52.4		< 21.5	1	40	Y		6.30	
MWDOP4					43.9		<18.7	1	40	Y		6.19	
MWDOP4					45.9		< 18.0	1	40	Y		5.65	
MWDOP4					46.1		< 18.6	1	40	Y		5.74	
MWDOP4					43.6		<15.8	1	40	Y		5.42	
MWDOP5					22.2		11.7	1	10	Y		5.88	
MWDOP5					22.0		14 7	1	20	Y		7.58	
MWDOP5					18.7		11.1	1	20	Y		6.89	
MWDOP5					16 6		9.5	1	20	Y		6.50	
MWDOP5					17 4		9.2	1	20	Y		5.75	
MWDOP5					17.5		< 10.6	1	20	Y		5.31	
MWDOP5					18.7		9.8	1	40	Y		6.90	
MWDOP5					16.3		9.2	1	40	Y		5.53	

Utility ID: MWDSC (ACWD, CCWD, EBMUD, MWD, SCVWD)

1. Study ID: Oxidation Demonstration Project (Optimization Study 9/95, etc.)

2. Source water: River (River, lake, groundwater, etc.)

3. Source water ID: California State Project Water (State Project water, blend of..., etc.)

4. If blended source water indicate sources and proportions: Source %

5. Describe level of study: (indicate with an 'X') Bench-scale / Pilot-scale / X Full-scale

In this data sheet, "Filt." refers to data collected after coagulation, flocculation, sedimentation, and filtration.

6. Indicate with an 'X' if data reported as "Filt." are from samples collected after sedimentation only: or after sedimentation and filtration: X

WATER QUALITY DATA: PRE-OZONE

Date	TOC (mg/L) Raw	TOC Ozon.	TOC Filt.	UV-254 (1/cm) Raw	UV-254 Ozon.	UV-254 Filt.	Alkalinity (mg/L as CaCO3) Raw	Alkalinity Ozon.	Alkalinity Filt.	Bromide (µg/L) Raw	Bromide Ozon.	Bromide Filt.	Turbidity (NTU) Raw	Turbidity Ozon.	Turbidity Filt.	pH () Raw	pH Ozon.	pH Filt.	Temperature (deg C) Raw	Temperature Ozon.	Temperature Filt.	Bromate (µg/L) Raw	Bromate Ozon.	Bromate Filt.
09/08/92	3.86			0.118	0.088		87				0.31		1.8			8.07	8.07		26.7				9.0	
09/08/92	3.86	3.82		0.118	0.081		87				0.31		1.5			7.96	7.96		25.6				12.0	
09/09/92				0.114	0.084						0.31		2.3			7.89	7.89		25.0				10.0	
09/09/92				0.113	0.085						0.31		2.4			7.89	7.89		25.0				11.0	
09/10/92				0.113	0.085						0.30		1.6			7.91	7.91		24.4				7.0	
09/10/92				0.114	0.081						0.30		1.5			8.00	8.00		24.4				11.0	
09/10/92				0.118	0.078						0.30		1.5			8.01	8.01		25.6				13.0	
09/18/92				0.108	0.078								1.6				8.67		22.3				6.0	
09/21/92				0.110												7.96	7.33		23.2				8.0	
09/21/92				0.110	0.084								1.6			7.96	7.98		23.2				7.0	
09/22/92																	7.34		23.2				6.0	
09/22/92																	7.18		23.2				7.0	
09/23/92	3.32			0.109	0.079		87				0.31		1.8			8.02	8.02		23.1				8.0	
09/24/92					0.072								1.8			8.02	8.20		23.3				3.0	
09/24/92					0.079								1.8			8.02	8.18		23.3				4.5	
09/24/92					0.087								1.8			8.02	8.08		33.3				6.5	
10/06/92	3.27			0.105			85				0.34		1.8			7.81	8.17		21.7				1.5	
10/06/92	3.27			0.105			85				0.34		1.8			7.81	8.20		21.7				8.0	
10/12/92																	8.08		21.0				1.5	
10/12/92																	8.02		21.0				1.5	
10/12/92																	8.03		21.0				1.5	
10/13/92																	7.32		20.9				1.5	
10/13/92																	7.09		20.9				5.0	
10/14/92																	7.15		20.8				5.0	
10/14/92																	7.08		20.8				7.0	
10/14/92																	7.06		20.8				7.5	
10/20/92																7.97	7.97		19.9				13.0	
10/20/92																7.97	7.97		19.9				15.5	
10/20/92																7.97	7.97		19.8				23.5	
10/26/92																7.92	7.92		18.5				13.0	
10/26/92																7.92	7.92		19.5				18.5	
10/26/92																7.92	7.92		18.5				19.0	
01/21/93	3.50						73				0.34		3.1			7.81	7.81		10.0				9.5	
01/21/93	3.50						73				0.34		3.1			7.81	7.81		10.0				15.5	
01/21/93	3.50						73				0.34		3.1			7.81	7.81		10.0				23.0	
03/16/93	2.84			0.099							0.19					7.72	7.72		12.0				3.0	
03/16/93	2.84			0.099							0.19					7.72	7.72		12.0				5.5	
03/16/93	2.84			0.099							0.19					7.72	7.72		12.0				5.5	
04/01/93													2.2			7.68	8.01		12.0				1.5	
04/01/93													2.2			7.68	8.11		12.0				1.5	
04/01/93													2.2			7.68	5.99		12.0				1.5	
04/01/93													2.2			7.68	5.99		12.0				1.5	
04/01/93													2.2			7.68	8.07		12.0				5.0	
04/02/93													2.3			7.66	7.66		12.0				1.5	
04/02/93													2.3			7.66	7.66		12.0				3.5	
04/02/93													2.3			7.66	7.66		12.0				4.5	
04/02/93													2.3			7.66	7.66		12.0				1.5	
04/02/93													2.3			7.66	7.66		12.0				13.0	
04/05/93	2.78			0.098			72				0.19					7.50	7.50		12.2				8.0	
04/05/93	2.78			0.098			72				0.19					7.50	7.50		12.2				43.5	
04/06/93																	5.93		12.3				3.0	
04/06/93																	8.08		12.3				5.0	
04/07/93											0.19		1.3			7.58	6.13		12.1				3.5	
04/07/93											0.18		1.3			7.58	6.18		12.1				1.5	
04/07/93											0.18		1.3			7.58	5.98		12.1				3.5	
04/07/93											0.34		1.3			7.58	5.92		12.1				3.0	
04/07/93											0.28		1.3			7.58	5.83		12.1				1.5	
04/08/93											0.33		1.3			7.60	7.60		12.1				8.0	
04/08/93											0.19		1.3			7.60	7.60		12.1				6.0	
04/08/93											0.21		1.3			7.60	7.60		12.1				6.0	
04/08/93											0.27		1.3			7.60	7.60		12.1				7.5	
04/08/93											0.17		1.3			7.60	7.60		12.1				6.0	
04/12/93	2.78			0.095			73				0.47					7.57	7.57		12.1				3.5	
04/21/93																	8.15		13.0				1.5	

TREATMENT CONDITIONS

Ozonation Conditions

Date	Ozone dose (mg/L)	Ozone residual (mg/L)	Contact time (min) (full contactor)	Ozone pH ()	Ozone temp. (deg. C)	Ozone residual (mg/L) Ch. 1A	Ozone residual (mg/L) Ch. 1B	Ozone residual (mg/L) Ch. 2A	Ozone residual (mg/L) Ch. 2B	Ozone residual (mg/L) Ch. 3A	Ozone residual (mg/L) Ch. 3B
09/08/92	1.9		12.1			0.32	<.01	<.01	<.01	<.01	<.01
09/08/92	2.0		12.1			0.42	0.02	0.01	<.01	<.01	0.01
09/09/92	1.9		12.2			0.31	0.04	0.04	0.04	0.05	0.04
09/09/92	1.9		12.0			0.32	0.02	0.01	0.01	0.01	0.01
09/10/92	1.6		12.3			0.18	<.01	<.01	<.01	<.01	<.01
09/10/92	1.9		12.3			0.32	0.01	0.01	<.01	<.01	<.01
09/10/92	2.2		12.2			0.44	0.03	0.03	0.03	0.02	0.02
09/18/92	1.7		12.1			0.40	0.11	0.03	0.03	0.02	0.02
09/21/92	1.5		12.2			0.34	0.05	0.05	0.04	0.03	0.04
09/21/92	1.6		12.2			0.25	0.04	0.03	0.04	0.03	0.03
09/22/92	1.3		12.1			0.26	0.03	0.03	0.03	0.02	0.02
09/22/92	1.4		12.2			0.27	0.04	0.03	0.03	0.03	0.03
09/23/92	1.7		12.3			0.36	0.03	0.03	0.03	0.03	0.03
09/24/92	1.2		12.2			0.30	0.04	0.04	0.04	0.03	0.04
09/24/92	1.5		12.3			0.51	0.09	0.04	0.04	0.03	0.03
09/24/92	1.7		12.2			0.75	0.18	0.10	0.04	0.04	0.04
10/06/92	1.0		12.1			0.20	0.02	0.02	0.02	0.02	0.01
10/06/92	1.2		12.3			0.34	0.04	0.02	0.02	0.02	0.02
10/12/92	1.0		12.2			0.20	0.02	0.01	0.01	<0.010	0.01
10/12/92	1.1		12.1			0.24	0.02	0.02	0.02	0.02	0.02
10/12/92	1.1		12.1			0.33	0.03	0.02	0.02	0.02	0.01
10/13/92	1.1		12.2			0.23	0.03	0.02	0.02	0.02	0.02
10/13/92	1.1		12.2			0.32	0.01	0.02	0.02	0.01	0.01
10/14/92	1.0		12.3			0.22	0.02	0.01	0.01	<0.010	<0.010
10/14/92	1.2		12.3			0.34	0.01	<0.010	<0.010	<0.010	<0.010
10/14/92	1.4		12.3			0.42	0.08	0.02	0.01	0.01	<0.010
10/20/92	1.8		6.1			0.59	0.11	0.04	<0.010	<0.010	<0.010
10/20/92	1.8		6.1			0.68	0.11	0.14	0.02	<0.010	<0.010
10/20/92	2.1		6.1			0.72	0.29	0.28	0.11	0.05	0.03
10/26/92	1.4		12.2			0.42	0.08	0.04	0.04	0.04	0.04
10/26/92	1.7		12.2			0.42	0.04	0.03	0.03	0.03	0.03
10/26/92	2.0		12.2			0.87	0.10	0.08	0.03	0.03	0.03
01/21/93	1.6		11.8			0.58	0.19	0.05	<0.010	<0.010	<0.010
01/21/93	1.9		12.2			0.76	0.23	0.11	0.03	<0.010	<0.010
01/21/93	2.2		12.1			0.88	0.47	0.22	0.09	0.05	0.01
03/16/93	1.0		12.3			0.21	<0.010	<0.010	<0.010	<0.010	<0.010
03/16/93	1.5		12.3			0.58	0.27	0.05	0.04	0.03	0.03
03/16/93	2.0		12.2			0.78	0.31	0.21	0.09	0.05	0.03
04/01/93	0.8		12.2			0.11	<0.010	0.01	0.01	0.02	<0.010
04/01/93	1.0		12.2			0.26	0.02	0.01	<0.010	0.01	0.01
04/01/93	1.2		12.2			0.45	0.10	0.08	0.03	0.03	0.03
04/01/93	1.5		12.2			0.70	0.38	0.24	0.13	0.08	0.05
04/01/93	1.8		12.2			0.88	0.44	0.38	0.31	0.23	0.18
04/02/93	1.0		12.2			0.23	0.02	0.02	0.01	0.02	0.02
04/02/93	1.3		12.2			0.44	0.07	0.02	0.02	0.02	0.02
04/02/93	1.5		12.2			0.46	0.09	0.06	0.02	0.02	0.02
04/02/93	1.7		12.1			0.83	0.33	0.19	0.08	0.03	0.02
04/02/93	2.0		12.1			1.07	0.44	0.31	0.17	0.10	0.04
04/05/93	1.6		12.2			0.74	0.18	0.11	0.02	0.02	0.02
04/05/93	4.0		12.2			2.01	1.71	1.58	1.30	1.09	0.97
04/06/93	1.2		12.2			0.54	0.15	0.09	0.04	0.04	0.05
04/06/93	1.8		12.2			0.75	0.30	0.25	0.18	0.12	0.08
04/07/93	1.2		12.2			0.41	0.06	0.01	0.01	0.02	0.02
04/07/93	1.2		12.2			0.39	0.08	0.05	0.04	0.03	0.04
04/07/93	1.2		12.2			0.38	0.07	0.04	0.01	0.02	0.01
04/07/93	1.2		12.1			0.47	0.10	0.08	0.02	0.02	0.02
04/07/93	1.2		12.1			0.40	0.11	0.06	0.02	0.02	0.02
04/08/93	1.5		12.1			0.52	0.18	0.08	0.03	0.04	0.04
04/08/93	1.5		12.2			0.48	0.10	0.06	0.03	0.03	0.03
04/08/93	1.5		12.2			0.57	0.18	0.08	0.03	0.03	0.02
04/08/93	1.5		12.1			0.61	0.14	0.03	0.02	0.02	0.02
04/08/93	1.5		12.2			0.53	0.08	0.03	0.01	0.02	0.01
04/12/93	1.0		12.2			0.23	0.01	<0.010	<0.010	<0.010	<0.010
04/21/93	0.7		12.1			0.13	0.03	0.03	0.03	0.02	0.02

C — 0 3 1 0 6 9

Date	TOC (mg/L) Raw	TOC Ozon.	TOC Fin.	UV-254 (1/cm) Raw	UV-254 Ozon.	UV-254 Fin.	Alkalinity (mg/L as CaCO3) Raw	Alkalinity Ozon.	Alkalinity Fin.	Bromide (µg/L) Raw	Bromide Ozon.	Bromide Fin.	Turbidity (NTU) Raw	Turbidity Ozon.	Turbidity Fin.
04/21/93															
04/21/93															
04/21/93															
04/21/93															
04/22/93															
04/22/93															
04/22/93															
04/22/93															
04/22/93															
04/26/93	3.07			0.100			70				0.18				
04/26/93	3.07			0.100			70				0.18				
04/27/93															
04/27/93															
04/28/93											0.53				
04/28/93											0.19				
04/28/93											0.30				
04/28/93											0.46				
04/28/93											0.25				
04/29/93											0.56				
04/29/93											0.22				
04/29/93											0.59				
05/03/93	3.18			0.108			77				0.56				
05/03/93	3.18			0.108			77				0.58				
05/03/93	3.18			0.108			77				0.44				
05/03/93	3.18			0.108			77				0.57				
05/04/93											0.47				
05/12/93											0.33				
05/12/93											0.32				
05/12/93											0.32				
05/12/93											0.32				
05/12/93											0.32				
05/13/93											0.33				
05/13/93											0.32				
05/13/93											0.33				
05/13/93											0.32				
05/13/93											0.33				
06/14/93							82				0.51				
06/14/93	3.34	3.83					82				0.50				
06/14/93							82				0.52				
06/21/93	3.53						85				0.48				
06/21/93	3.53						85				0.48				
06/21/93	3.53	3.75					85				0.48				
06/28/93	3.59						84				0.54				
06/28/93	3.59						84				0.50				
06/28/93	3.58	3.78					84				0.53				
07/06/93				0.116			84				0.51				
07/06/93				0.116			88				0.48				
07/06/93				0.116	0.068		88				0.49				
07/28/93											0.53				
07/28/93											0.50				
07/28/93											0.52				
07/19/94	3.38 (d)	3.19 (d)	3.02 (d)	0.087	0.062	0.047	80				0.21		1.55		
07/25/94	3.19 (d)	3.11 (d)	2.75 (d)	0.091	0.065	0.041	80				0.22		1.1		
08/01/94	3.43 (d)	3.30 (d)	2.95 (d)	0.091							0.22		1.3		
08/16/94													0.9		
08/17/94													1.4		
08/17/94															
08/18/94	3.52 (d)	3.52 (d)	2.87 (d)	0.084	0.058	0.041							1.6		
08/29/94	3.54 (d)	3.68 (d)	2.80 (d)	0.093	0.058	0.042	82				0.22		0.9		
10/24/94	3.10 (d)	3.17 (d)	2.74 (d)	0.088	0.050	0.036	77				0.26		0.74		
10/26/94															
10/26/94															
10/26/94															
10/26/94															
10/26/94															
10/26/94															
10/27/94															
10/27/94															
10/27/94															
10/28/94															
10/28/94															
10/28/94															
10/31/94	3.02 (d)	2.76 (d)	2.17 (d)	0.083	0.040	0.036	78				0.29		0.75		
11/01/94											0.40				
11/01/94											0.35				
11/01/94											0.40				
11/01/94											0.41				
11/01/94											0.40				
11/01/94											0.40				
11/02/94											0.43				
11/02/94											0.38				

Date	pH Raw	pH Ozon.	pH Fin.	Temperature (deg. C) Raw	Temperature Ozon.	Temperature Fin.	Bromate (µg/L) Raw	Bromate Ozon.	Bromate Fin.	Ozone dose (mg/L)	Ozone residual (mg/L)	Contact time (min) (full contactor)	Ozone pH 0	Ozone temp. (deg. C)	Ozone residual (mg/L) Ch. 1A	Ozone residual (mg/L) Ch. 1B	Ozone residual (mg/L) Ch. 2A	Ozone residual (mg/L) Ch. 2B	Ozone residual (mg/L) Ch. 3A	Ozone residual (mg/L) Ch. 3B
04/21/93		6.11		13.0				1.5		1.0		12.1			0.19	0.02	0.01	0.02	0.03	0.02
04/21/93		5.98		13.0				1.5		1.3		12.2			0.38	0.09	0.03	0.02	0.02	0.03
04/21/93		6.06		13.0				3.0		1.5		12.3			0.58	0.15	0.09	0.02	0.02	0.02
04/21/93		5.99		13.0				3.5		1.7		12.2			0.77	0.28	0.17	0.12	0.07	0.04
04/22/93		7.30		13.2				1.5		1.0		12.3			0.19	<0.010	<0.010	<0.010	<0.010	<0.010
04/22/93		7.30		13.2				1.5		1.2		12.3			0.25	0.04	0.01	0.01	0.01	<0.010
04/22/93		7.30		13.2				1.5		1.5		12.3			0.40	0.01	0.01	<0.010	<0.010	<0.010
04/22/93		7.30		13.2				1.5		1.7		12.2			0.60	0.18	0.08	0.03	0.01	0.02
04/22/93		7.30		13.2				6.0		2.0		12.2			0.97	0.29	0.14	0.07	0.04	0.02
04/26/93		7.29		13.5				3.5		1.6		12.3			0.40	0.06	0.01	<0.010	0.02	<0.010
04/26/93		7.29		13.5				32.0		4.0		12.2			1.80	1.52	1.32	1.03	0.85	0.72
04/27/93		6.09		13.8				1.5		1.2		12.2			0.33	0.01	0.01	0.01	0.01	0.01
04/27/93		6.10		13.8				1.5		1.6		12.3			0.51	0.12	0.03	<0.010	0.02	0.01
04/28/93		5.89		14.2				1.5		1.2		12.2			0.15	<0.010	<0.010	<0.010	<0.010	<0.010
04/28/93		6.09		14.2				1.5		1.2		12.2			0.17	<0.010	<0.010	<0.010	<0.010	<0.010
04/28/93		6.13		14.2				1.5		1.2		12.1			0.10	<0.010	<0.010	<0.010	<0.010	<0.010
04/28/93		5.90		14.2				1.5		1.2		12.1			0.15	<0.010	<0.010	<0.010	<0.010	<0.010
04/28/93		6.11		14.2				1.5		1.2		12.2			0.08	<0.010	<0.010	0.01	<0.010	<0.010
04/29/93	9.41	9.41		17.2				1.5		1.5		12.2			0.03	<0.010	<0.010	<0.010	<0.010	<0.010
04/29/93	9.37	9.37		17.2				1.5		1.5		12.2			0.03	<0.010	<0.010	<0.010	<0.010	<0.010
04/29/93	9.27	9.27		17.2				27.5		4.1		12.2			0.35	0.03	0.03	0.01	<0.010	0.01
05/03/93	8.30	8.30		16.3				8.0		1.5		12.2			0.33	0.04	0.03	0.03	0.03	0.03
05/03/93	8.30	8.30		16.3				12.0		1.7		12.2			0.48	0.03	0.02	0.02	0.02	0.02
05/03/93	8.30	8.30		16.3				14.5		2.0		12.2			0.50	0.02	0.02	0.02	0.02	0.02
05/03/93	8.30	8.30		16.3				22.5		2.3		12.2			0.72	0.13	0.02	0.01	0.02	0.01
05/04/93		6.04		16.0				6.0		2.0		12.2			1.07	0.40	0.21	0.13	0.09	0.05
05/12/93		6.07		16.0				1.5		1.0		12.1			0.15	<0.010	<0.010	<0.010	0.04	0.02
05/12/93		8.03		16.0				1.5		1.2		12.1			0.30	0.01	<0.010	0.01	0.01	<0.010
05/12/93		8.02		16.0				1.5		1.5		12.1			0.46	0.10	0.03	0.02	0.02	0.02
05/12/93		6.10		16.0				3.0		1.7		12.1			0.66	0.19	0.12	0.02	0.02	0.01
05/12/93		5.84		16.0				1.5		2.0		12.1			0.71	0.41	0.20	0.08	0.04	0.01
05/13/93	8.06	8.06		16.0				3.5		1.2		12.2			0.14	0.01	0.01	0.01	0.01	0.02
05/13/93	8.06	8.06		16.0				5.5		1.5		12.1			0.27	0.02	0.02	0.01	0.02	0.02
05/13/93	8.06	8.06		16.0				7.0		1.7		12.2			0.44	0.02	0.02	0.02	0.02	0.02
05/13/93	8.06	8.06		16.0				10.0		2.0		12.1			0.85	0.09	0.02	0.03	0.02	0.03
05/13/93	8.06	8.06		16.0				13.0		2.2		12.2			0.73	0.11	0.03	0.02	0.02	0.02
06/14/93	7.78	7.78		19.2				14.5		2.0		12.2			0.47	0.05	0.00	0.00	0.00	0.00
06/14/93	7.78	7.78		19.2				20.5		2.4		12.1			0.87	0.20	0.08	0.00	0.00	0.00
06/14/93	7.78	7.78		19.2				31.0		2.7		12.2			0.87	0.20	0.18	0.02	0.00	0.00
06/21/93	7.89	7.89		20.5				4.5		1.5		12.3			0.17	<0.010	<0.010	0.00	0.00	0.00
06/21/93	7.89	7.89		20.5				8.5		2.0		12.3			0.44	0.01	<0.010	0.00	0.00	0.00
06/21/93	7.89	7.89		20.5				19.0		2.5		12.2			0.63	0.13	0.04	0.00	0.00	0.00
06/28/93	7.87	7.87		20.8				12.5		1.6		12.2			0.17	0.02	0.01	0.00	0.00	0.00
06/28/93	7.87	7.87		20.8				6.0		2.0		12.2			0.44	0.02	0.01	0.00	0.00	0.00
06/28/93	7.87	7.87		20.8				23.5		2.5		12.2			0.55	0.14	0.09	0.02	0.00	0.00
07/06/93	7.93	7.93		21.7				4.5		1.5		12.2			0.16	0.01	0.00	0.00	0.00	0.00
07/06/93	7.93	7.93		21.7				9.0		2.0		12.2			0.36	0.02	0.02	0.00	0.00	0.00
07/06/93	7.93	7.93		21.7				18.5		2.4		12.3			0.39	0.06	0.02	0.00	0.00	0.00
07/28/93	8.07	8.07		21.2				13.0		2.0		12.3			0.42	0.03	0.04	0.00	0.00	0.00
07/28/93	8.07	8.07		21.2				12.5		2.0		6.1			0.45	0.11	0.05	0.00	0.00	0.00
07/28/93	8.07	8.07		21.2				12.0		2.1		17.9			0.24	0.03	0.03	0.00	0.00	0.00
07/19/94	8.13	8.13	7.80	23.2				1.5		1.6		6.5			0.43	0.04	0.03	0.00	0.00	0.00
07/25/94	8.26	8.26	7.87	23.4				9.0		1.7		6.5			0.52	0.08	0.08	0.00	0.00	0.00
08/01/94	8.14	8.14	7.71	23.7				6.0		2.0		6.8			0.75	0.13	0.19	0.00	0.00	0.00
08/16/94	8.10	8.25	7.85	24.6				3.0		1.4		6.5			0.35	0.11	0.11	0.03	0.00	0.00
08/17/94	8.70	6.15	6.25	24.8				1.5		1.4		6.5			0.48	0.23	0.17	0.08	0.00	0.00
08/17/94	8.70	7.15		24.8				5.0		1.5		6.4			0.39	0.10	0.10	0.03	0.00	0.00
08/18/94	8.56	7.15	7.14	24.8				4.0		1.5		6.5			0.46	0.14	0.13	0.04	0.00	0.00
08/29/94	8.85	7.58	7.30	24.2				1.5		1.4		6.5			0.35	0.06	0.05	0.00	0.00	0.00
10/24/94	7.93	7.92	7.70	18.8				11.0		1.7		6.5			0.55	0.23	0.22	0.10	0.00	0.00
10/26/94	7.94	7.00		18.6				3.0		1.0		6.4			0.20	0.05	0.06	0.02	0.00	0.00
10/26/94	7.84	7.08		18.6				7.5		1.5		6.5			0.53	0.25	0.28	0.23	0.10	0.05
10/26/94	7.90	7.90		18.6				7.0		1.5		6.5			0.45	0.20	0.11	0.01	0.00	0.00
10/26/94	7.84	7.08		18.6				13.0		2.0		6.4			0.85	0.58	0.51	0.36	0.32	0.24
10/26/94	7.91	7.91		18.6				15.5		2.0		6.5			0.68	0.31	0.28	0.14	0.09	0.04
10/26/94	7.84	7.84		18.6				26.0		2.5		6.5			1.06	0.63	0.57	0.33	0.27	0.18
10/27/94		8.39		18.4				1.5		1.0		6.4			0.35	0.11	0.11	0.05	0.02	0.02
10/27/94		8.38		18.4				1.5		1.3		6.4			0.80	0.30	0.29	0.17	0.13	0.08
10/27/94		8.40		18.4				3.0		1.5		6.4			0.58	0.39	0.42	0.29	0.28	0.20
10/28/94		5.90		18.3				1.5		1.0		6.4			0.42	0.14	0.14	0.07	0.05	0.04
10/28/94		5.97		18.3				1.5		1.2		6.4			0.64	0.28	0.30	0.20	0.18	0.12
10/28/94		5.90		18.3				1.5		1.5		6.4			0.88	0.44	0.47	0.36	0.29	0.23
10/31/94	8.01	7.93	7.82	18.2				10.0		1.5		6.5			0.52	0.23	0.19	0.07	0.00	0.00
11/01/94	7.98	6.96		18.2				4.0		1.0		6.4			0.42	0.17	0.15	0.07	0.06	0.04
11/01/94	7.98	6.82		18.2				8.5		1.5		6.4			0.90	0.62	0.46	0.26	0.23	0.18
11/01/94	7.98	7.98		18.2				14.0		1.5		6.4			0.68	0.33	0.25	0.10	0.06	0.02
11/01/94	7.98	6.82		18.2				11.0		2.0		6.4			1.11	1.21	0.78	0.63	0.53	0.42
11/01/94	7.98	7.98		18.2				26.0		2.0		6.4			0.87	0.48	0.45	0.29	0.21	0.13
11/01/94	7.96	7.96		18.2				36.0		2.5		6.4			1.38	0.80	0.74	0.52	0.46	0.33
11/02/94		6.43		17.8				1.5		1.0		6.4			0.31	0.10	0.09	0.04	0.02	0.01
11/02/94		6.05		17.8				1.5		1.0		6.4			0.34	0.12	0.12	0.05	0.04	<0.010

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C-031070

Date	TOC			UV-254			Alkalinity			Bromide			Turbidity			pH			Temperature			Bromate			Ozone	Ozone	Contact	Ozone	Ozone	Ozonation Conditions					
	(mg/L)			(1/cm)			(mg/L as CaCO3)			(µg/L)			(NTU)			()			(deg. C)			(µg/L)			dose	residual	time	pH	temp.	Ozone residual	Ozone residual	Ozone residual	Ozone residual	Ozone residual	Ozone residual
	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	(mg/L)	(mg/L)	(min) (full contactor)	()	(deg. C)	(mg/L) Ch. 1A	(mg/L) Ch. 1B	(mg/L) Ch. 2A	(mg/L) Ch. 2B	(mg/L) Ch. 3A	(mg/L) Ch. 3B
11/02/94											0.42						8.41		17.8				4.0		1.2		8.4			0.53	0.34	0.29	0.18	0.13	0.09
11/02/94											0.41						8.05		17.8				4.0		1.3		8.4			0.51	0.29	0.28	0.18	0.14	0.09
11/02/94											0.41						8.41		17.8				5.0		1.5		8.4			0.60	0.31	0.38	0.27	0.23	0.18
11/02/94											0.42						8.05		17.8				3.5		1.5		8.4			0.82	0.48	0.50	0.33	0.30	0.23
11/07/94	2.78 (d)	2.81 (d)	2.29 (d)	0.080	0.048	0.033	78				0.28		0.7			7.87	7.97	7.63	16.4				15.0		1.7		8.5			0.78	0.48	0.38	0.20	0.00	0.00
11/08/94											0.53					7.90	8.92		16.2				6.0		1.0		8.4			0.43	0.18	0.18	0.08	0.07	0.03
11/08/94											0.55					7.90	7.90		16.2				12.5		1.2		8.4			0.52	0.17	0.19	0.08	0.05	0.04
11/08/94											0.54					7.90	8.87		16.2				9.5		1.5		8.4			0.88	0.58	0.55	0.40	0.35	0.31
11/08/94											0.55					7.90	7.90		16.2				21.0		1.5		8.4			0.70	0.37	0.33	0.17	0.11	0.07
11/08/94											0.58					7.90	8.87		16.2				12.0		2.0		8.4			1.23	0.84	0.88	0.74	0.65	0.58
11/08/94											0.54					7.90	7.90		16.2				34.5		2.0		8.4			0.98	0.55	0.57	0.45	0.37	0.29
11/10/94											0.54						8.44		15.9				3.0		1.0		8.4			0.38	0.14	0.15	0.08	0.08	0.02
11/10/94											0.54						8.06		15.9				1.5		1.8		8.4			0.40	0.18	0.21	0.11	0.10	0.05
11/10/94											0.54						8.10		15.9				3.0		1.2		8.4			0.48	0.33	0.32	0.24	0.21	0.17
11/10/94											0.53						8.44		15.9				5.0		1.3		8.4			0.80	0.37	0.33	0.22	0.17	0.12
11/10/94											0.53						8.05		15.9				4.0		1.5		8.4			0.89	0.48	0.52	0.41	0.36	0.31
11/10/94											0.56						8.44		15.9				5.0		1.5		8.4			0.77	0.48	0.52	0.38	0.33	0.28
11/14/94	2.78 (d)	2.89 (d)	2.38 (d)	0.080	0.048	0.033	75				0.29		0.64			8.31	8.29	7.85	15.1				8.0		1.5		8.5			0.54	0.13	0.18	0.08	0.00	0.00
11/29/94	2.74 (d)	2.82 (d)	2.38 (d)				80				0.30		1.05			8.33	8.37	7.70	12.7				7.0		1.5		8.4			0.51	0.23	0.21	0.08	0.00	0.00
12/06/94	2.81 (d)	2.66 (d)	2.22 (d)								0.33		1.5			8.02	8.03	7.63	11.3				10.0		1.3		8.5			0.82	0.31	0.30	0.15	0.12	0.07
12/14/94													1.8			8.08	8.08	7.70	11.9				9.0		1.2		8.5			0.58	0.32	0.28	0.15	0.10	0.07
12/20/94	2.87 (d)	2.73 (d)	2.38 (d)	0.078	0.045	0.038	82						1.2			8.08	8.08	7.78	10.1				9.0		1.2		8.4			0.82	0.35	0.27	0.15	0.12	0.08
12/28/94	2.85 (d)	2.85 (d)	2.41 (d)	0.078	0.053	0.036	82				0.34		1.1			8.11	8.11	7.97	9.8				7.0		1.2		8.5			0.48	0.30	0.27	0.15	0.12	0.07
01/06/95	2.48 (d)	2.56 (d)	2.08 (d)	0.077	0.047	0.031							0.68			8.15	8.15	7.78	10.0				6.0		1.2		8.4			0.44	0.25	0.23	0.14	0.10	0.05
01/10/95	2.42 (d)	2.46 (d)	2.15 (d)	0.079	0.050	0.032	79				0.31		1.4			8.22	8.22	7.83	10.4				8.0		1.2		8.4			0.54	0.23	0.23	0.13	0.08	0.05
01/18/95	2.46 (d)	2.48 (d)	2.10 (d)	0.073	0.047	0.035	79				0.31		2.2			8.07	8.07	7.71	10.2				8.0		1.2		8.5			0.48	0.21	0.24	0.10	0.08	0.04
01/24/95	2.73 (d)	2.70 (d)	2.32 (d)	0.076	0.045	0.033	78				0.31		1.3			8.12	8.12	7.78	10.3				8.0		1.3		8.5			0.58	0.26	0.25	0.11	0.09	0.05
01/31/95	2.58 (d)	2.58 (d)	2.22 (d)	0.072	0.041	0.032	78				0.29		0.77			8.51	8.51	8.00	11.1				8.0		1.5		8.5			0.54	0.22	0.22	0.08	0.05	0.01
02/01/95	2.23						78				0.50					8.58	7.86		11.7				14.0		1.8		8.5			0.78	0.43	0.48	0.38	0.30	0.23
02/02/95	2.50										0.50					8.36	7.80		11.3				21.5		2.0		8.5			1.25	0.70	0.74	0.58	0.52	0.43
02/07/95	2.78 (d)	2.83 (d)	2.38 (d)	0.082	0.047	0.035	78				0.28		0.85			8.28	8.28	7.78	11.8				12.0		1.8		8.5			0.58	0.28	0.27	0.13	0.08	0.03
02/14/95	2.82 (d)	2.80 (d)	2.61 (d)	0.085	0.048	0.036	80				0.28		0.9			8.37	8.37	8.00	11.4				12.0		1.8		8.4			0.68	0.29	0.28	0.14	0.08	0.03
02/28/95	3.12 (d)	3.31 (d)	2.68 (d)	0.088	0.056	0.038					0.27		1.8			8.80	7.78	7.58	12.8				6.0		1.8		8.5			0.47	0.19	0.19	0.07	0.03	<0.01
06/13/95	3.37			0.110			66			0.14			4.2			8.59	8.59		19.4				4.0		3.0		6.5			0.70	0.15	0.07	0.03	0.02	0.02
06/14/95	3.27			0.104			68			0.14	0.34		3.5			8.52	8.52		19.4				21.0		3.3		6.5			0.65	0.19	0.18	0.01	0.01	0.01
06/15/95	3.40			0.108			68				0.40		5.8			8.52	7.43		19.4				18.0		3.0		6.5			0.72	0.47	0.49	0.26	0.18	0.08

Utility ID: SCVWD (ACWD, CCWD, EBMUD, MWD, SCVWD)

1. Study ID: Pilot Study 93-94 (Optimization Study 9/95, etc.)

2. Source water: South Bay Aqueduct (River, lake, groundwater, etc.)

3. Source water ID: State Project Water (State Project water, blend of ..., etc.)

4. If blended source water indicate sources and proportions:

Source	%

5. Describe level of study: (indicate with an 'X')

	Bench-scale
X	Pilot-scale
	Full-scale

In this data sheet, "Filt." refers to data collected after coagulation, flocculation, sedimentation, and filtration.

6. Indicate with an 'X' if data reported as "Filt." are from samples collected after sedimentation only:
or after sedimentation and filtration: X

WATER QUALITY DATA: CONVENTIONAL

Date	TOC (mg/L)		UV-254 (1/cm)		Alkalinity (mg/L as CaCO3)		Hardness (mg/L as CaCO3)				Bromide (µg/L)		Chloride (mg Cl-/L)		TDS (mg/L)		Turbidity (NTU)		pH ()		Temperature (deg. C)	
							Total		Calcium													
	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.	Raw	Filt.
11/3/93	3.46	2.48	0.127	0.0532	83	81	117	117			170		61		232	237	2.9	0.071	8.1	7.98	18.7	21
11/4/93	3.32	2.14	0.113	0.0346	85	70	122	122			150		57		230	234	2.09	0.054	7.58	6.96	18.7	20.9
11/16/93	2.81	1.52	0.112	0.0238	60	8	103	103			230		75		235	253	7.19	0.096	7.48	5.52	18.8	17.5
11/17/93	3.05	0.78	0.118	0.011	62	21	105	105			220		71		238	255	10.13	3.17	7.42	5.53	16.4	18.1
11/18/93	2.94	0.92	0.114	0.013	70	26	105	105			220		74		241	251	4.68	0.048	7.24	6.24	17.5	18.2
11/3/93	3.46	2.46	0.127	0.049	83	67	117	117			170		61		232	240	2.9	0.066	7.6	6.8	18.7	21
11/3/93	3.46	1.22	0.127	0.023	83	66	117	117			170		61		232	242	2.9	0.06	7.6	6.49	18.7	21.3
11/4/93	3.32	2.16	0.113	0.039	85	68	122	122			150		57		230	240	2.09	0.063	7.58	7	18.7	20
11/4/93	3.32	0.7	0.113	0.010	85	39	122	122			150		57		230	250	2.09	0.041	7.58	6.44	18.7	21.3
11/15/93	2.96	1.05	0.123	0.016	71	12	108	108			170		72		237	260	4.76	0.046	7.75	5.49	17.7	18.7
11/15/93	2.96	1.63	0.123	0.026	71	13	108	108			170		72		237	253	4.76	0.096	7.75	5.52	17.7	17.5
11/16/93	2.81	0.94	0.112	0.016	60	7	103	103			230		75		235	257	7.19	0.051	7.48	5.58	16.8	17.8
2/15/94	4.82	2.74	0.215	0.057	83	55	115	115			180				219	234	7.37	0.101	7.59	6.4	12.5	13.3
4/25/94	4.8	2.57	0.181	0.046	81	58	124	124			650	290	70		272	283	5.94	0.07	7.87	6.71	16.9	17.2
4/27/94	4.67	2.49	0.168	0.041	82	57	127	127			630		73		274	291	7.97	0.067	7.64	6.78	17.1	17.9
4/28/94	4.58	2.4	0.193	0.040	81	59	126	126			550		74		280	293	8.69	0.09	7.5	6.77	18	18.3
5/2/94	4.56	2.53	0.161	0.041	81	60	127	127			560		72		281	292	5.34	0.085	8.13	6.71	17.6	17.9
5/16/94	3.97	2.57	0.142	0.053	95	80	129	129			450		50		241	246	5.57	0.104	8.04	7.06	16.2	18.1
5/16/94	3.97	2.57	0.142	0.053	95	80	129	129			450		50		241	246	5.57	0.104	8.04	7.06	16.2	18.1
5/16/94	3.97	2.57	0.142	0.053	95	80	129	129			450		50		241	246	5.57	0.104	8.04	7.06	16.2	18.1
5/16/94	3.97	2.57	0.142	0.053	95	80	129	129			450		50		241	246	5.57	0.104	8.04	7.06	16.2	18.1
5/17/94	3.79	2.68	0.155	0.056	81	69	120	120			530		69		266	259	4.92	0.087	8.71	7.28	18.5	18.5
5/19/94	3.86	2.57	0.141	0.050	85	71	120	120			500		69		261	273	5.4	0.063	8.56	7.06	18.5	18.9
5/24/94	3.89	2.73	0.136	0.050	89	82	128	128			670		54		238	242	6.84	0.083	8.12	6.99	16.8	20
3/1/94	5.57	2.31	0.262	0.045	70	53	113	113			170	120			235	250	9.66	0.099	7.6	6.23	14.5	15.8
3/1/94	5.57	2.31	0.262	0.045	70	53	113	113			170	120			235	250	9.66	0.099	7.6	6.23	14.5	15.8
3/1/94	5.57	2.31	0.262	0.045	70	53	113	113			170	120			235	250	9.66	0.099	7.6	6.23	14.5	15.8
3/1/94	5.57	2.31	0.262	0.045	70	53	113	113			170	120			235	250	9.66	0.099	7.6	6.23	14.5	15.8
6/13/94	3.2	2.08	0.121	0.048	77	68	115	115			560		71		263	268	4.5	0.072	8.1	7.16	19	20.2
6/14/94	3.22	2.48	0.114	0.054	78	65	117	117			600				263	278	4.53	0.117	8.29	7.32	19.9	21.2
6/15/94	3.25	2.6	0.118	0.059	78	75	113	113			600	290	73		267	275	4.88	0.098	8.2	7.45	18.2	20.1
6/16/94	3.15	1.67	0.118	0.027	79	43	114	114			1000	560	73		266	282	4.25	0.073	7.98	6.55	17.3	19.7

C-031072

Utility ID:

1. Study ID:

2. Source wa

3. Source wa

5. Describe I
(indicate wit

6. Indicate w

Indicate coagulants studied:

ID	oagulan	Chemical formula	Units
1	Alum	Al2(SO4)3	mg/L
2	erric Chl	FeCl3	mg/L
3			
4			

WATER Q

TREATMENT CONDITIONS

Date	Chlorination conditions: Filtered: Indicate disinfectant(s) used with an 'X': chlorine	chloramine	Chlorine dose (mg Cl2/L)	Ammonia dose (mg NH3-N/L)	Incububation time (h): chlorine	chloramine	Incub. temp. (deg. C)	pH ()	Residual FREE (mg Cl2/L)	Disinfection By-products: TTHM (µg/L) Raw	TTHM Filt.	HAA5 (µg/L) Raw	HAA5 Filt.	HAA6 (µg/L) Raw	HAA6 Filt.	Coagulation Conditions: Coagulant ID (see above)	Dose	Acid adjusted? (Y/N)	Base adjusted? (Y/N)	Coag. pH ()	Coag. temp. (deg. C)
11/3/93	X	X	2.4	0.56	0.25	72	20 to 25	7.98	1.68		38		25.7		29.6	1	20	N	N	7.98	20
11/4/93	X	X	2.4	0.60	0.25	72	20 to 25	8.05	1.8		31		25.4		29.3	1	28	N	N	6.96	19.4
11/16/93	X	X	2.4	0.33	0.25	72	20 to 25	8.02	1		23		22.5		25.9	1	40	Y	N	5.52	17.1
11/17/93	X	X	2.4	0.39	0.25	72	20 to 25	8.05	1.17		14		18.5		20	1	40	Y	N	5.53	18.8
11/18/93	X	X	2.4	0.35	0.25	72	20 to 25	8.05	1.05		14		18.5		20	1	40	Y	N	8.24	18.6
11/3/93	X	X	2.3	0.69	0.17	72	20 to 25	6.8	2.07		34		24.7		29.3	2	15	N	N	6.73	19.8
11/3/93	X	X	2.3	0.57	0.17	72	20 to 25	6.8	1.72		21		13.5		15	2	15	N	N	6.59	20.3
11/4/93	X	X		0.55	0.17	72	20 to 25	7	1.65		35		19.7		23.8	2	15	N	N	7.06	19.5
11/4/93	X	X		0.69	0.17	72	20 to 25	6.48	2.07		11		13.5		15	2	45	N	N	6.3	19.3
11/15/93	X	X		0.36	0.25	72	20 to 25	5.61	1.07		18		15.4		16.9	2	30	Y	N	5.48	16.9
11/15/93	X	X		0.35	0.25	72	20 to 25	5.68	1.05		23		16.5		20.3	2	40	Y	N	5.49	18.6
11/16/93	X	X		0.35	0.25	72	20 to 25	5.67	1.05		20		13.5		15	2	30	Y	N	5.5	17.2
2/15/94	X	X	2	0.67	0.08	72	20 to 25	8.4	2		45		33.2		39.2	2	37	N	N	8.3	12.9
4/25/94	X	X	2	0.39	0.25	72	20 to 25	8.71	1.16		88		18.8		20.3	2	22	N	N	6.66	17.5
4/27/94	X	X	2	0.32	0.50	72	20 to 25	6.78	0.97		74		20.4		23.7	2	23	N	N	6.77	17.1
4/28/94	X	X	2	0.33	0.50	72	20 to 25	6.77	1		78		18.8		22.1	2	23	N	N	5.84	16.5
5/2/94	X	X	2	0.33	0.50	72	20 to 25	6.71	0.99		79		23		24.5	2	23	N	N	6.78	17.4
5/16/94	X	X	2	0.33	0.25	72	20 to 25	7.06	1		62		23		26.6	2	23	N	N	7.08	17.3
5/16/94	X	X	2	0.31	0.50	72	20 to 25	7.06	0.93		70		23		26.6	2	23	N	N	7.08	17.3
5/16/94	X	X	2	0.18	1.00	72	20 to 25	7.06	0.54		75		23		26.6	2	23	N	N	7.08	17.3
5/16/94	X	X	2	0.10	2.00	72	20 to 25	7.06	0.3		80		25		28.7	2	23	N	N	7.08	17.3
5/17/94	X	X	2	0.27	0.50	72	20 to 25	7.28	0.82		96		21.3		25.1	2	23	N	N	7.39	18.9
5/19/94	X	X	2	0.28	0.50	72	20 to 25	7.08	0.85		95		24		25.5	2	23	N	N	7.14	18.7
5/24/94	X	X	2	0.24	0.50	72	20 to 25	6.99	0.72		73		20.4		24.5	2	26	N	N	6.99	19.9
3/1/94	X	X	2	0.38	0.25	72	20 to 25	8.23	1.15		43		13.5		15	2	43	N	N	6.54	15.1
3/1/94	X	X	2	0.33	0.50	72	20 to 25	8.23	1		38		15.2		19.1	2	43	N	N	6.54	15.1
3/1/94	X	X	2	0.27	1.00	72	20 to 25	8.23	0.8		38		15.2		16.7	2	43	N	N	6.54	15.1
3/1/94	X	X	2	0.22	2.00	72	20 to 25	8.23	0.65		39		18		22.3	2	43	N	N	6.54	15.1
6/13/94	X	X	2	0.30	0.25	72	20 to 25	7.16	0.89		55		25		30	2	30	N	N	7.07	19.7
6/14/94	X	X	2	0.29	0.50	72	20 to 25	7.32	0.87				31.3		40.7	2	30	N	N	7.37	20.5
8/15/94	X	X	2	0.25	0.50	72	20 to 25	7.45	0.74				28		35.3	2	30	N	N	7.16	19.6
8/16/94	X	X	2	0.17	0.50	72	20 to 25	8.55	0.51				83.9		93.7	2	32	N	N	6.62	19.6

C—031073

C-031074

Utility ID:	SCVWD	(ACWD, CCWD, EBMUD, MWD, SCVWD)
1. Study ID:	Pilot Study 93-94	(Optimization Study 9/95, etc.)
2. Source water:	South Bay Aqueduct - San luis Reservoir	(River, lake, groundwater, etc.)
3. Source water ID:	State and Federal Water Projects	(State Project water, blend of...., etc.)
	5. Describe level of study:	Bench-scale
	(indicate with an 'X') X	Pilot-scale
		Full-scale

WATER QUALITY DATA: CONVENTIONAL+OZONE

Date	Time	TOC (mg/L)				UV-254 (1/cm)				Alkalinity (mg/L as CaCO3)				Hardness (mg/L as CaCO3) Total				Bromide (µg/L)				Ammonia (mg NH3-N/L)				Chloride (mg Cl-/L)				TDS (mg/L)				
		Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw
5/11/93		3.51	2.59		2					68	44			110	110			170			110									236	254			11
5/18/93		3.58	2.37		1.64	0.027	0.034			62	49		41	105	110		107	160			140									234	233		220	10
5/25/93		5.86	3.09		2.17	0.041				79	58		52	130	130		130	230			190									270	282		290	6
2/15/94		4.82	2.66		1.73	0.215	0.293		0.026	83	50		57	115	115		115	160			100									219	230		233	7.37
3/1/94		5.57	2.99		2.27	0.262	0.023		0.029	70	44		43	113	113		113	170			140									235	248		242	9.66
3/14/94		3.09	2.18		1.67	0.114			0.023	70	53		56	107	107		107	200			130									243	245		249	1.429
4/25/94		4.6	3.06		2.32	0.181	0.209		0.033	81	59		59	124	124		124	550		550	370					70				272	283		284	5.94
4/25/94		4.6	3.06		1.55	0.181	0.209		0.023	81	59		56	124	124		124	550		550	320					70				272	283		284	5.94
5/16/94		3.97	3		2.24	0.142	0.218		0.031	95	79		79	129	129		129	450		480	320					50				241	245		246	5.57
5/16/94		3.97	3		1.85	0.142	0.218		0.025	95			74	129			129	450		480	330					50				241			246	5.57
6/13/94		3.2	2.17		1.69	0.121	0.123		0.026	77	59		58	115	115		115	560		360	390					71				263	267		269	4.5
6/13/94		3.2	2.17		1.32	0.121	0.123		0.021	77	59		56	115	115		115	560		360	370					71				263	267		269	4.5
	Bromate Data																																	
5/11/93		3.51	2.59		2					68	44			110	110			170			110									236				11
5/18/93		3.58	2.37		1.64	0.027	0.034			62	49		41	105	110		107	160			140									234			220	10
5/25/93		5.86	3.09		2.17	0.041				79	58		52	130	130		130	230			190									270			290	6
5/26/93		6.56	3.19			0.043				79	68		6.5	131				220												285			290	6
8/18/93		2.78	1.33			0.136	0.146			45	15			45												16				88.6			51	21
8/25/93		4.13								38	17			38	36			170								32				46.8				15
8/26/93		2.34	1.06			0.128	0.115			40	18		17	41	41											16				52.7			69	13
9/1/93		2.52	1.2			0.128	0.151			43	12		15	48	48			50	740							16				58.2			78	22.8
10/4/93		3.62	2.23			0.107	0.146			87	59		57	105	105		105	80	200				0.5			30				168			179	7.16
10/5/93		3.56	2.69			0.109	0.180			95	56		70	110	110		110	80	580				0.5			31				173			182	7.2
10/6/93		3.6	1.97			0.098	0.147			92	61		51	109	109		109	90					0.5			32				180			197	9.73
10/7/93		3.48	2.37			0.102	0.160			93	68		64	102	102		102	90	460				0.5			33				177			191	9.79
10/7/93		3.48				0.102				93	68		64	102	102		102	90	460				0.5			33				177			191	9.79
10/12/93		3.67				0.106				96	79		62	116	116		116	90	250				0.5			32				178			200	5.42
10/12/93		3.67	3.03			0.106	0.182			96	79		62	116	116		116	90	250				0.5			32				178			200	5.42
10/13/93		3.42	3.89			0.096	0.256			96	82		33	112	112		112	90	730				0.5			32				179			220	5.68
10/13/93		3.42	3.89			0.096	0.256			96	82		33	112	112		112	90	730				0.5			32				179			220	5.68
10/14/93		5.02	4.02			0.150	0.273			65	65		56	107	107		107	120	720							62				228			217	3.4
10/14/93		5.02	2.84			0.150	0.174			65	51		29	107	107		107	120	720							62				228			233	3.4
10/14/93		5.02				0.150				65	51		29	107	107		107	120	720							62				228			233	3.4
1/27/94										71	46		50	112	112		112	200												241			251	11.07
2/15/94		4.82	2.66		1.73	0.215	0.293			83	50		57	115	115		115	160			100									219			233	7.37
3/1/94		5.57	2.99		2.27	0.262	0.023			70	44		43	113	113		113	170			140									235			242	9.66
3/14/94		3.09	2.18		1.67	0.114				70	53		56	107	107		107	200			130									243			249	1.429
4/25/94		4.6	3.06		2.32	0.181	0.209			81	59		59	124	124		124	210	550		370					70				272			284	5.94
4/27/94		4.67	3.08			0.168	0.226			82	61		60	127	127		127	190	530		520					73				274			288	7.97
4/28/94		4.58	3.09			0.193	0.217			81	63		61	126	126		126	190	550		490					74				280			285	8.69
5/2/94		4.56	3.06			0.161	0.224			81	58		62	127	126		127	200	560		550					72				281			290	5.34
5/16/94		3.97	3		2.24	0.142	0.218			85	79		79	129	129		129	180	450		3					50				241			246	5.57
5/17/94		3.79	2.96			0.155	0.210			81	66		68	120	120		120	180	530		320					69				266			277	4.92
5/19/94		3.86	2.79			0.141	0.190			85	71		70	120	120		120	180	500							69				261			274	5.4
5/24/94		3.89	2.73			0.136	0.232			89	71		78	128	128		128	180	670		510					54				236			247	6.84
6/13/94		3.2	2.17		1.69	0.121	0.123			77	59		58	115	115		115	200	560		390					71				263			269	4.5
6/14/94		3.22	2.06			0.114	0.101			78	58		58	117	117		117	180	600		570									263			277	4.53
6/15/94		3.25	2.24			0.118	0.116			78	62		58	113	113		113	220	600		600					73				267			273	4.88
6/16/94		3.15	2.19			0.118	0.157			79	60		61	114	114		114	200	1000		1000					73				266			273	4.25

C-031074

Utility ID:

1. Study

2. Source

3. Source

WATER

Date	Turbidity (NTU) Settl.	Turbidity Ozon.	Turbidity Filt.	pH () Raw	pH Settl.	pH Ozon.	pH Filt.	Temperature (deg. C) Raw	Temperature Settl.	Temperature Ozon.	Temperature Filt.	Bromate (µg/L) Raw	Bromate Settl.	Bromate Ozon.	Bromate Filt.	HPC (CFU/mL) Raw	HPC Settl.	HPC Ozon.	HPC Filt.	Chlorination conditions, Filtered: Indicate disinfectant(s) used with an 'X' chlorine	chloramine	Chlorine dose (mg Cl2/L)	Ammonia dose (mg NH3-N/L)	Incububation time (h) chlorine	Incububation time (h) chloramine	Incub. temp. (deg. C)	pH ()	Residual (mg Cl2/L)	T (µ Raw	Settl.
5/11/93	2		0.08	7.8	6.43	6.43		20	19.2			2			1				3933	X	X	2.5	0.73	0.083	168	20-25	6.8	2.18		
5/18/93	1.7		0.1	7.8	6.56	6.56	6.56	21	21.5		21.8	11.5							108	X	X	2.5	0.66	0.083	168	20-26	6.68	1.97		
5/25/93	3			6.8	6.33	6.33		18.7	17.8			16.5			13.5				3100	X	X	2.5	0.73	0.083	168	20-27	6.41	2.2		
2/15/94	2.32		0.164	7.59	6.24	6.24	6.34	12.5	12.8		14.8	1			2	820			1900	X	X	2	0.49	0.083	168	20-28	6.34	1.46		
3/1/94	3.05		0.077	7.6	6.4	6.4	6.52	14.5	14.1		16.6	1			2	2100			1300	X	X	2	0.45	0.083	168	20-29	6.52	1.35		
3/14/94	1.499		0.087	7.28	6.76	6.76	6.58	12.9	14.2		18	2.2			2.6				2800	X	X	2	0.58	0.083	168	20-30	6.58	1.67		
4/25/94	2.02		0.05	7.87	6.69	6.69	6.92	16.9	17.2		17.9	2			2	81			570	X	X	2	0.50	0.083	168	20-31	6.92	1.49		
4/25/94	2.02		0.053	7.87	6.69	6.69	6.79	16.9	17.2		18.2	2			2	81			2100	X	X	2	0.47	0.083	168	20-32	6.79	1.42		
5/16/94	2.14		0.066	8.04	7.04	7.04	6.98	16.2	17.7		18.6	2.4			2.9	1500			1300	X	X	2	0.53	0.083	168	20-33	6.98	1.59		
5/16/94	2.14		0.067	8.04	7.04	7.04	6.9	16.2	17.7		18.4	2.4			2	1500			3100	X	X	2	0.51	0.083	168	20-34	6.9	1.52		
6/13/94	1.14		0.041	8.1	6.8	6.8	6.87	19	19.5		20.8	3.5			3.2	690			860	X	X	2	0.47	0.083	168	20-35	6.87	1.41		
6/13/94	1.14		0.029	8.1	6.8	6.8	6.97	19	19.5		21	3.5			2.4	690			3100	X	X	2	0.47	0.083	168	20-36	6.97	1.42		
5/11/93	2		0.08	7.8	6.43	6.43		20	19.2					2	1															
5/18/93	1.7		0.1	7.8	6.56	6.56	6.56	21	21.5		21.8			11.5																
5/25/93	3			6.8	6.33	6.33		18.7	17.8					16.5	13.5															
5/26/93	4.2		0.28	6.8	6.8	6.8	6.49	17.3	16.7		18			23																
8/18/93	2		0.097	7.4	6.103	6.103	6.21	22.9	23.9		25.8				1															
8/25/93	1.7		0.05	7.3	6.11	6.11		23	25.3						2.2															
8/26/93	1.5		0.1	7.6	6.21	6.21	6.35	22.5	26.3		27.4				4.1															
9/1/93	2		0.02	7.47	5.93	5.93	6.06	23.7	25		26.5				1															
10/4/93	1.27		0.04	7.74	6.52	6.52	6.44	19	19.5		20.5				1															
10/5/93	1.14		0.058	7.81	6.62	6.62	7	18.2	18.6		18.9				4.2															
10/6/93	1.28		0.083	7.81	6.77	6.77	6.64	17.7	17.8		19.7				4.7															
10/7/93	1.81		0.058	7.94	6.89	6.89	6.9	18.4	19.3		22				4.7															
10/7/93	1.81		0.058	7.94	6.89	6.89	6.9	18.4	19.3		22				4.3															
10/12/93	2.9		0.065	7.6	6.98	6.98	6.75	18.5	19		20.9				12.4															
10/12/93	2.9		0.065	7.6	6.98	6.98	6.75	18.5	19		20.9				1															
10/13/93	2.18		0.128	7.93	7.16	7.16	6.1	18.6	19.4		20				1															
10/13/93	2.18		0.128	7.93	7.16	7.16	6.1	18.6	19.4		20				1															
10/14/93	3.4		0.26	7	7	7	6.53	19	19		20.3				9.1															
10/14/93	1.34		0.09	7	6.67	6.67	6.15	19	19.2		20.2				6.4															
10/14/93	1.34		0.09	7	6.67	6.67	6.15	19	19.2		20.2				2.7															
1/27/94	3.36		0.415	7.15	6.28	6.28	6.33	11.9	13		15.4				2															
2/15/94	2.32		0.164	7.59	6.24	6.24	6.34	12.5	12.8		14.8			1	2															
3/1/94	3.05		0.077	7.6	6.4	6.4	6.52	14.5	14.1		16.6			1	2															
3/14/94	1.499		0.087	7.28	6.76	6.76	6.58	12.9	14.2		18			2.2	2.6															
4/25/94	2.02		0.05	7.87	6.69	6.69	6.92	16.9	17.2		17.9			2	2															
4/27/94	2.73		0.058	7.64	6.89	6.89	6.89	17.1	17.1		18.5			2	2															
4/28/94	2.72		0.071	7.5	6.91	6.91	6.84	16	16.8		18.3			2	2															
5/2/94	1.89		0.074	8.13	6.74	6.74	6.8	17.6	17.4		18.5			2	2															
5/16/94	2.14		0.066	8.04	7.04	7.04	6.98	16.2	17.7		18.6			2.4	2.9															
5/17/94	1.79		0.054	8.71	7.16	7.16	7.12	18.5	18.9		19.6			2.7	2.8															
5/19/94	2.16		0.058	8.56	7.12	7.12	6.99	18.5	18.4		19.7			2.1	2.1															
5/24/94	2.04		0.056	8.12	6.83	6.83	6.87	16.8	19.3		20.9			2	2															
6/13/94	1.14		0.041	8.1	6.8	6.8	6.87	19	19.5		20.8			3.5	3.2															
6/14/94	1.94		0.044	8.29	7	7	6.92	19.9	20.1		21.9			4	3.2															
6/15/94	0.97		0.037	8.2	6.79	6.79	7.04	18.2	19.8		20.5			2.2	2.1															
6/16/94	1.58		0.032	7.98	6.93	6.93	6.97	17.3	18.6		20.4			2.9	2.5															

C-031075

Utility ID:

1. Study

2. Source

3. Source

Indicate coagulants studied:

ID	Coagulant	Chemical formula	Units
1	Alum	Al2(SO4)3	mg/L
2	Ferric Chlo.	FeCl3	mg/L
3			
4			

WATER

TREATMENT CONDITIONS

Date	Disinfection By-products														Coagulation Conditions						Ozonation Conditions				
	M (/L)		HAA5 (µg/L)				HAA6 (µg/L)				TOX (µg Cl-/L)				Coagulant ID	Dose	Acid adjusted?	Base adjusted?	Coag. pH	Coag. temp.	Ozone dose	Ozone residual	Contact time	Ozone pH	Ozone temp.
	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	Raw	Settl.	Ozon.	Filt.	(see above)		(Y/N)	(Y/N)	()	(deg. C)	(mg/L)	(mg/L)	(min)	()	(deg. C)
5/11/93		12				60.3				61.8					2	20	N		6.43	19.2	1.6	0.7	12	6.4	19.2
5/18/93		7				16				17.5					2	20	N		6.56	21.5	2.1	1.3	12	6.56	21.5
5/25/93		11				25				37					2	30	N		6.33	17.8	3.4	1.33	12	6.22	19.7
2/15/94		23				15.2				16.7					2	30	N		6.24	12.8	1.2	0.28	12	6.24	13.3
3/1/94		20				13.5				15					2	30	N		6.4	14.1	0.9	0.12	12	6.36	15.7
3/14/94		14				13.5				15					2	22	N		6.76	14.2	0.9	0.15	12	6.51	18.5
4/25/94		48				17.4				18.9					2	20	N		6.69	17.2	0.7	0.15	12	6.7	17.3
4/25/94		30				15.2				16.7					2	20	N		6.69	17.2	0.7	0.15	12	6.7	17.3
5/16/94		30				17.9				19.4					2	20	N		7.04	17.7	0.9	0.18	12	7.04	17.7
5/16/94		29				15.9				17.4					2	20	N		7.04	17.7	0.9	0.18	12	7.04	17.7
6/13/94		28				17.4				18.9					2	20	N		6.8	19.5	0.9	0.18	12	6.91	19.6
6/13/94		42				15.7				17.2					2	20			6.8	19.5	0.9	0.18	12	6.91	19.6
5/11/93																					1.6	0.7	12	6.4	19.2
5/18/93																					2.1	1.3	12	6.56	21.5
5/25/93																					3.4	1.33	12	6.22	19.7
5/26/93																					4	1.06	12	6.8	16.7
8/18/93																					0.7	0.16	12	6.21	25.8
8/25/93																					1.6	0.27	12	6.3	23
8/26/93																					2.7	1.13	12	6.1	26.8
9/1/93																					0.8	0.26	12	5.96	25.1
10/4/93																					0.8	0.22	12	6.48	19.6
10/5/93																					1.7	0.74	12		
10/6/93																					2.7	1.65	12		
10/7/93																					0.8	0.16	12	6.9	20
10/7/93																					1.7	0.83	12		
10/12/93																					2.7	1.35	12	6.99	19.8
10/12/93																					0.7	0.2	12		
10/13/93																					1.6	0.78	12	6.05	19.7
10/13/93																					2.6	1.31	12	5.98	19.3
10/14/93																					2.2	0.63	12		
10/14/93																					2.6	1.28	12		
10/14/93																					2.2	0.63	12		
1/27/94																					1	0.23	12	6.28	13
2/15/94																					1.2	0.28	12	6.24	13.3
3/1/94																					0.9	0.12	12	6.36	15.7
3/14/94																					0.9	0.15	12	6.51	18.5
4/25/94																					0.7	0.15	12	6.7	17.3
4/27/94																					1	0.2	12	6.84	18
4/28/94																					1	0.25	12	6.94	16.9
5/2/94																					1	0.18	12	6.8	18.5
5/16/94																					0.9	0.18	12	7.04	17.7
5/17/94																					1.05	0.26	12	7.12	18.7
5/19/94																					1.05	0.27	12	7.05	19
5/24/94																					0.9	0.18	12	6.8	19.8
6/13/94																					0.9	0.18	12	6.91	19.6
6/14/94																					0.9	0.24	12	7.06	19.1
6/15/94																					0.9	0.24	12	7	19
6/16/94																					0.9	0.19	12	7	18.4

Utility ID:			SCVWD				(ACWD, CCWD, EBMUD, MWD, SCVWD)																										
1. Study ID:			Pilot Study				(Optimization Study 9/95, etc.)																										
2. Source water:			South Bay Aqueduct - San Luis Reservoir				(River, lake, groundwater, etc.)																										
3. Source water ID:			State and Federal Water Projects				(State Project water, blend of …, etc.)																										
5. Describe level of study:				Bench-scale		In this data sheet, "Filt." refers to data collected																											
(indicate with an 'X')			X	Pilot-scale		after coagulation, flocculation, sedimentation, and																											
				Full-scale		filtration.																											
6. Indicate with an 'X' if data reported as "Filt." are from samples collected after sedimentation only:																																	
				or after sedimentation and filtration:			X																										

WATER QUALITY DATA: PRE-OZONE

Date	Time	TOC (mg/L)			UV-254 (1/cm)			Alkalinity (mg/L as CaCO3)			Hardness (mg/L as CaCO3) Total			Bromide (µg/L)			Ammonia (mg NH3-N/L)			Chloride (mg Cl-/L)			TDS (mg/L)			Turbidity (NTU)			pH ()			Tempera (deg.	
		Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon.	Filt.	Raw	Ozon
5/11/93		3.51		2.13				68			110			0.17		0.16							236			11		0.05	7.8	7.8	6.64	20	20
5/18/93		3.58		1.85				62		48	105		108	0.16		0.16							234		220	10		0.05	7.8	7.8	6.66	21	21
5/25/93		5.88		2.97				79		52	130		131	0.23		0.22							270		292	6			6.8	6.8		18.7	18.1
11/17/93		3.05		2.06	0.118		0.029	62		69	105		105	0.22		0.23				71			238		262	10.13		0.074	7.42		7.86	16.4	
1/4/94		3.44		1.91	0.120		0.028	64		53	103		103	0.23		0.14							235		223	2.9		0.17	7.7		8.7	13.5	
1/5/94		3.27		1.83	0.119		0.030	69		47	102		102	0.89									236		243	2.46		0.092	7.48		6.75	12.8	
1/5/94		3.27		1.09	0.119		0.018	69		56	102			0.89		0.68							236		243	2.46		0.085	7.48		6.81	12.8	
2/15/94		4.82		2.05	0.215		0.033	83			115		115	0.16		0.12							219			7.37			7.59	7.02		12.5	12.5
3/1/94		5.57		2.46	0.262		0.032	70		42	113		113	0.17		0.14							235		248	9.66		0.134	7.6	7.15	6.48	14.5	14.1
3/14/94		3.09		1.49	0.114		0.018	70		53	107		107	0.2		0.14							243		250	1.429		0.083	7.28	7.23	6.43	12.9	14.3
4/25/94		4.6		2.19	0.181		0.027	81		59	124		124	0.55	0.55	0.37				70			272		283	5.94		0.047	7.87	7.18	6.59	16.9	17
4/25/94		4.6		1.39	0.181		0.022	81		51	124		124	0.55	0.55	0.31				70			272		286	5.94		0.071	7.87	7.18	6.53	16.9	17
5/16/94		3.97		2.1	0.142		0.028	95		75	129		129	0.45	0.46	0.32				50			241		247	5.57		0.071	8.04	7.85	6.85	16.2	17.2
5/16/94		3.97		1.79	0.142		0.023	95		7	129		129	0.45	0.46	0.24				50			241		248	5.57		0.069	8.04	7.85	6.8	16.2	17.2
	Bromate Data																																
5/11/93		3.51		2.13				68			110			170		160							236			11		0.05	7.8	20	7.87	20	
5/13/93		4.17			0.028			70			113			170									241			11		0.06	7.8	20	8.3	20	
5/18/93		3.58		1.85				62		48	105		108	160		160							234		220	10		0.05	7.8	21	6.66	21	
5/19/93		3.55						63		37	111			160									233			9		0.09	7.3		6.03	22	
5/25/93		5.86		2.97				79		52	130		131	230		220							270		292	6			6.8	18.1		18.7	
5/26/93		6.56			0.043			79		5.3	131			220									285		298	6		0.1	6.8	18.2	6.7	17.3	
8/18/93		2.78			0.136			45			45									16			88.6		53	21		0.176	7.4	23.8	5.3	22.9	
8/25/93		4.13						38			38			170		140				32			46.8			15		0.05	7.3	21.5		23	
8/26/93		2.34			0.128			40		5	41			100		110				16			52.7		68.2	13		0.041	7.6	24.8	5.44	22.5	
9/1/93		2.52			0.128			43		18	48			740		530				16			58.2		66	22.8		0.02	7.47	23.7	6.07	23.7	
10/4/93		3.62			0.107			87			105			200		180		0.5		30			168		184	7.18		0.069	7.74	20	6.34	19	
10/5/93		3.56			0.109			95		54	110		110	580		540		0.5		31			173		186	7.2		0.075	7.81	18.8	6.6	18.2	
10/7/93		3.48			0.102			93		50	102		102	460		0.46		0.5		33			177		197	9.79		0.052	7.94	19.6	6.6	18.4	
10/12/93		3.87			0.106			96		22	116		116	250		250		0.5		32			178		204	5.42		0.063	7.8	18.6	5.7	18.5	
11/17/93		3.05		2.06	0.118			62		69	105		105	220		230				71			238		262	10.13		0.074	7.42		7.86	16.4	
12/6/93		3.27		1.95	0.115			68		55	103		103			160				69			244		252	1.6		0.06	7.5	16.8	6.68	16	
1/4/94		3.44		1.91	0.120			64		53	103		103	230		140							235		223	2.9		0.17	7.7		8.7	13.5	
1/5/94		3.27		1.83	0.119			69		47	102		102	890									236		243	2.46		0.092	7.48		6.75	12.8	
1/5/94		3.27		1.09	0.119			69		56	102			890		680							236		243	2.46		0.085	7.48		6.81	12.8	
1/27/94								71		45	112		112	200									241		248	11.07		0.202	7.15	12.3	8.25	11.9	
2/15/94		4.82		2.05	0.215			83			115		115	160		120							219			7.37			7.59	12.5		12.5	
3/1/94		5.57		2.46	0.262			70		42	113		113	170		140							235		248	9.66		0.134	7.6	14.1	6.48	14.5	
3/14/94		3.09		1.49	0.114			70		53	107		107	200		140							243		250	1.429		0.083	7.28	14.3	6.43	12.9	
4/25/94		4.6		2.19	0.181			81		59	124		124	550	550	370				70			272		283	5.94		0.047	7.87	17	6.59	16.9	
4/25/94		4.6		1.39	0.181			81		51	124		124	550	550	310				70			272		286	5.94		0.071	7.87	17	6.53	16.9	
4/27/94		4.67			0.168			82		58	127		127	530	540	430				73			274		287	7.97		0.058	7.64	16.9	6.77	17.1	
4/27/94		4.67			0.168			82		58	127		127	530	540	470				73			274		290	7.97		0.06	7.64	16.9	6.8	17.1	
4/28/94		4.58			0.193			81		57	126		126	550	550	533				74			280		291	8.69		0.078	7.5	16.4	6.78	16	
4/28/94		4.58			0.193			81		61	126		126	550	550	420				74			280		288	8.69		0.08	7.5	16.4	6.77	16	
5/2/94		4.56			0.181			81		63	127		127	560	570	570				72			281		289	5.34		0.081	8.13		6.67	17.6	
5/2/94		4.56			0.181			81		60	127		127	560	570	480				72			281		288	5.34		0.089	8.13		6.6	17.6	
5/16/94		3.97		2.1	0.142			95		75	129		129	450	460	0.32				50			241		247	5.57		0.071	8.04	17.2	6.85	16.2	
5/16/94		3.97		1.79	0.142			95		7	129		129	450	460	0.24				50			241		248	5.57		0.069	8.04	17.2	6.8	16.2	
5/17/94		3.79			0.155			81		61	120		120	530	560	0.52				69			266		277	4.92		0.042	8.71	18.3	6.97	18.5	
5/17/94		3.79			0.155			81		62	120		120	530	560	0.47				69			266		277	4.92		0.053	8.71	18.3	7.03	18.5	
5/19/94		3.86			0.141			85		71	120		120	500						69			261		271	5.4		0.092	8.56	18.7	7.05	18.5	
5/19/94		3.86			0.141			85		70	120		120	500						69			261		271	5.4		0.089	8.56	18.7	6.98	18.5	
5/24/94		3.89			0.136			89		75	128		128	670	550	0.5				54			236		246	6.84		0.051	8.12	19	6.82	16.8	
5/24/94		3.89			0.136			89		75	128		128	670	550	0.43				54			236		247	6.84		0.054	8.12	19	6.89	16.8	

C-031078

Utility ID:	
1. Study ID:	
2. Source wa	
3. Source wa	
5. Describe I	
(indicate wit	
6. Indicate w	

Indicate coagulants stu

ID	Coagulant
1	Alum
2	Ferric Chlo
3	
4	

WATER Q

TREATMENT CONDI

Date	re Filt.	Bromate (µg/L) Raw	Bromate (µg/L) Ozon.	Bromate (µg/L) Filt.	HPC (CFU/mL) Raw	HPC (CFU/mL) Ozon.	HPC (CFU/mL) Filt.	Chlorination conditions, Filtered: Indicate disinfectant(s) used with an 'X': chlorine	Indicate disinfectant(s) used with an 'X': chloramine	Chlorine dose (mg Cl2/L)	Ammonia dose (mg NH3-N/L)	Incububation time (h): chlorine	Incububation time (h): chloramine	Incub. temp. (deg. C)	pH ()	Residual (mg Cl2/L)	Disinfection By-products: TTHM (µg/L) Raw	TTHM (µg/L) Ozon.	TTHM (µg/L) Filt.	HAA5 (µg/L) Raw	HAA5 (µg/L) Ozon.	HAA5 (µg/L) Filt.	HAA6 (µg/L) Raw	HAA6 (µg/L) Ozon.	HAA6 (µg/L) Filt.	Coagu Coagulant ID (see above)	Dose
5/11/93	21.5		4.1	5 3			13851	X	X	2.5	0 67	0 083	168	20-25	6 94	2 01			19			21.01			40.01	2	20
5/18/93	22 2		18 3	13.5			192	X	X	2.5	0 69	0 083	168	20-25	6 84	2 07			9			11.07			20.07	2	20
5/25/93			18.7	13 3			5700	X	X	2.5	0.70	0 083	168	20-25	6 4	2.1			16			18.1			34.1	2	30
11/17/93	17.8			13.7				X	X		0.00	0.000	168	20-25	8	0			1			1			2	2	25
1/4/94	18.1			5.8			1400	X	X		0.33	0 083	168	20-25	6.7	1						1			1	2	15
1/5/94	15.5			14 5			15390	X	X		0.33	0 083	168	20-25	6 8	1			56 5			57.5			114	2	
1/5/94	15.5			14 4			14250	X	X		0 33	0 083	168	20-25	6.7	1			38.5			39 5			78	2	
2/15/94			2 4	5 3	820		5700	X	X	2	0.50	0 083	168	20-25	6 3	1.5			23			24.5			47.5	2	30
3/1/94	16.7		2	2.4	2100		1900	X	X	2	0.78	0 083	168	20-25	6 48	2.35			23			25.35			48.35	2	40
3/14/94	20.2		7.5	6 8			4200	X	X	2	0 53	0.083	168	20-25	6 43	1 6			21			22 6			43.6	2	26
4/25/94	17.6		10.5	9.64	81		860	X	X	2	0 52	0 083	168	20-25	6 59	1.55			46			47 55			93.55	2	21.5
4/25/94	17.5		10 5	6	81		3100	X	X	2	0 43	0 083	168	20-25	6 53	1 3			30			31.3			61.3	2	21 5
5/16/94	18 7		16 5	13 6	1500		1900	X	X	2	0 51	0 083	168	20-25	6 85	1 52			37			38 52			75 52	2	21
5/18/94	18.2		16 5	7.1	1500		2400	X	X	2	0 52	0 083	168	20-25	6 8	1.55			32			33 55			65 55	2	21
5/11/93	21.5		4.1	5.3																						2	20
5/13/93	20		12.1																							2	20
5/18/93	22 2		16 3	13.5																						2	20
5/19/93	22.9		20																							2	20
5/25/93			18.7	13.3																						2	30
5/26/93	17.3		16																							2	5.3
8/18/93	24 9			1																						2	20
8/25/93				4.2																						2	10
8/26/93	27.5			3.8																						2	10
9/1/93	26.5			13 8																						2	20
10/4/93	19.7			2.4																						2	20
10/5/93	19 5			11.1																						2	20
10/7/93	20.9			12																						2	20
10/12/93	20.7			1																						2	20
11/17/93	17.8			13.7																						2	25
12/8/93	17.4			69.7																						2	15
1/4/94	18.1			5 8																						2	15
1/5/94	15.5			14 5																						2	
1/5/94	15.5			14.4																						2	
1/27/94	15			3 3																						2	25
2/15/94			2.4	5.3																						2	30
3/1/94	16 7		2	2.4																						2	40
3/14/94	20 2		7.5	6.8																						2	26
4/25/94	17.6		10.5	9 64																						2	21 5
4/25/94	17.5		10.5	6																						2	21 5
4/27/94	18.3		6.6	8 9																						2	21
4/27/94	18.4		6 6	6.2																						2	21
4/28/94	18.1		7.6	6 5																						2	22
4/28/94	18.2		7 6	3 3																						2	22
5/2/94	18 8		5.4	5																						2	22
5/2/94	18 7		5.4	2																						2	22
5/16/94	18.7		16 5	13 6																						2	21
5/18/94	18.2		16.5	7.1																						2	21
5/17/94	19 5		6.3	4.3																						2	21
5/17/94	19.5		6 3	3.3																						2	21
5/19/94	19.7		20.4	18 8																						2	21
5/19/94	19.6		20.4	17.5																						2	21
5/24/94	20 9		7 3	6.1																						2	25
5/24/94	20 5		7.3	3.1																						2	25

C — 0 3 1 0 7 8

Utility ID:									
1. Study ID:									
2. Source wa									
3. Source wa									
	ed:								
5. Describe I	Chemical formula		Units						
(indicate wit	Al2(SO4)3		mg/L						
	FeCl3		mg/L						
6. Indicate w									
WATER Q	IONS								
Date	tion Conditions				Ozonation Conditions				
	Acid adjusted? (Y/N)	Base adjusted? (Y/N)	Coag. pH ()	Coag. temp. (deg. C)	Ozone dose (mg/L)	Ozone residual (mg/L)	Contact time (min)	Ozone pH ()	Ozone temp. (deg. C)
5/11/93			6.64	19.7	3	0.43		7.8	20
5/18/93			6.73	22.2	4	0.52		7.8	21
5/25/93					5.3	0.71	18.36	6.8	16.1
11/17/93			7.68	17.7	3	0.43	12.24		
1/4/94			7.15	14.5	1.5	0.18	12.24		
1/5/94			6.78	14.2			12.24		
1/5/94			6.72	14.4	1.8	0.38	12.24		
2/15/94			6.3	12.7	3.1	0.32	12.24	7.02	12.5
3/1/94			6.36	15.2	3.4	0.48	12.24	7.15	14.1
3/14/94			6.51	15.7	2.3	0.45	12.24	7.23	14.3
4/25/94			6.63	17.3	3.5	0.57	12.24	7.16	17
4/25/94			6.63	17.3	3.5	0.57	12.24	7.16	17
5/16/94			7	17.5	2.5	0.4	12.24	7.85	17.2
5/16/94			7	17.5	2.5	0.4	12.24	7.85	17.2
5/11/93			6.64	19.7	3	0.43	18.36	7.8	20
5/13/93			6.29	20	3.1	0.85	18.36	6.5	20
5/18/93			6.73	22.2	4	0.52	18.36	7.8	21
5/19/93			6.04	23	4.7	1.3	12.24		
5/25/93					5.3	0.71	18.36	6.8	16.1
5/26/93			6.65	17.2	6.5	0.45	18.36	7	16.2
8/18/93			5.43	24.5	1.9	0.3	12.24	5.94	23.8
8/25/93			5.4	25.9	2.9	0.45	12.24	6.3	21.5
8/26/93			4.21	26.1	3.6	1.31	12.24	5.95	24.8
9/1/93			6.32	25.4	2.4	0.46	12.24	7.47	23.7
10/4/93			6.45	19.6	1.5	0.24	12.24	6.45	20
10/5/93			6.56	19.2	1.5	0.23	18.36	7.04	18.8
10/7/93			5.57	19.8	3.1	1.07	12.24	6.99	19.6
10/12/93			5.52	19.9	1.2	0.12	12.24	6.01	16.6
11/17/93			7.68	17.7	3	0.43	12.24		
12/6/93			6.6	17	5	1.29	12.24	7.56	16.8
1/4/94			7.15	14.5	1.5	0.18	12.24		
1/5/94			6.78	14.2			12.24		
1/5/94			6.72	14.4	1.8	0.36			
1/27/94			6.18	13.4	3.2	0.47	12.24	7.18	12.3
2/15/94			6.3	12.7	3.1	0.32		7.02	12.5
3/1/94			6.36	15.2	3.4	0.48	12.24	7.15	14.1
3/14/94			6.51	15.7	2.3	0.45	12.24	7.23	14.3
4/25/94			6.63	17.3	3.5	0.57	12.24	7.16	17
4/25/94			6.63	17.3	3.5	0.57	12.24	7.18	17
4/27/94			6.82	17.1	4.85	0.5	12.24	7.32	16.9
4/27/94			6.82	17.1	4.85	0.5	12.24	7.32	16.9
4/28/94			6.85	17	3	0.62	12.24	7.63	16.4
4/28/94			6.85	17	3	0.62	12.24	7.63	16.4
5/2/94			6.85	18.1	2.9	0.27	12.24		
5/2/94			6.85	18.1	2.9	0.27	12.24		
5/16/94			7	17.5	2.5	0.4		7.85	17.2
5/16/94			7	17.5	2.5	0.4	12.24	7.85	17.2
5/17/94			18.8	6.97	2.5	0.38	12.24	8.4	18.3
5/17/94			18.8	6.97	2.5	0.38	12.24	8.4	18.3
5/19/94			7.19	19.1	2.6	0.27	12.24	8.35	18.7
5/19/94			7.19	19.1	2.6	0.27	12.24	8.35	18.7
5/24/94			6.88	19.8	2.2	0.27	12.24	7.5	19
5/24/94			6.88	19.8	2.2	0.27	12.24	7.5	19
							12.24		

DELTA WATER QUALITY AND TREATMENT LIMITATIONS FOR CURRENTLY AVAILABLE ADVANCED WATER TREATMENT TECHNOLOGY[1]

Drinking water regulations must balance health risks from microbial and chemical contaminants. Chlorination, the traditional method of controlling microbial risks, reacts with naturally occurring matter in water to produce Disinfection By-products (DBPs), which are suspected cancer-causing compounds. Pathogens such as viruses, *Giardia* and *Cryptosporidium* pose acute, short-term gastrointestinal health effects which, in the case of *Cryptosporidium*, can be life-threatening to those with weakened immune systems including infants and the elderly. As depicted in Figure 1, the ability to balance risks from pathogens and DBPs is controlled by a combination of source water quality and practical limitations of treatment technology.

EPA is currently developing parallel regulations for controlling DBPs (Stage 1 and 2 of the DBP Rule) and waterborne disease agents (Interim and Enhanced Surface Water Treatment Rule). Both of these regulations will require most water utilities to implement newer, more expensive treatment technologies. Enhanced coagulation and ozonation are considered best available technologies for complying with these regulations. More advanced treatment technologies such as filtration membranes and granulated activated carbon are extremely expensive and have potential environmental implementation ramifications. Given this, it is important to know the required source water quality which will allow current best available technology to perform within expected future drinking water standards. With the Delta providing the source water for all or a portion of the water supply for two-thirds of the state's population, its quality will be critical in future water treatment management decisions.

Traditional water treatment technology of filtration and disinfection with chlorine was acceptable until regulations requiring a reduction in DBPs forced many entities to begin

[1] Prepared by California Urban Water Agencies

reducing chlorine contact time or use a combination of ammonia and chlorine (chloramines) which reduced DBPs. However, these methods cannot meet expected Stage 1 requirements for *Giardia*, DBPs, and total organic carbon (TOC) removal when using Delta water. Therefore, enhanced coagulation or ozone is required. Although enhanced coagulation, in combination with free chlorine, can control DBPs and *Giardia*, chlorination is ineffective against *Cryptosporidium*. Ozone disinfection is also very effective for controlling *Giardia* while limiting the formation of many DBPs, and can even disinfect for *Cryptosporidium*. However, as greater quantities of ozone are required for disinfection of *Cryptosporidium*, disinfection by-products of the ozonation process occur. Principle among these is the compound bromate, a DBP to be regulated in the DBP rule. Bromate is formed by the reaction of ozone with bromide, with higher levels of either constituent producing more bromate. Delta waters commonly contain bromide, borne by seawater mixing with Delta inflow on the tidal cycle.

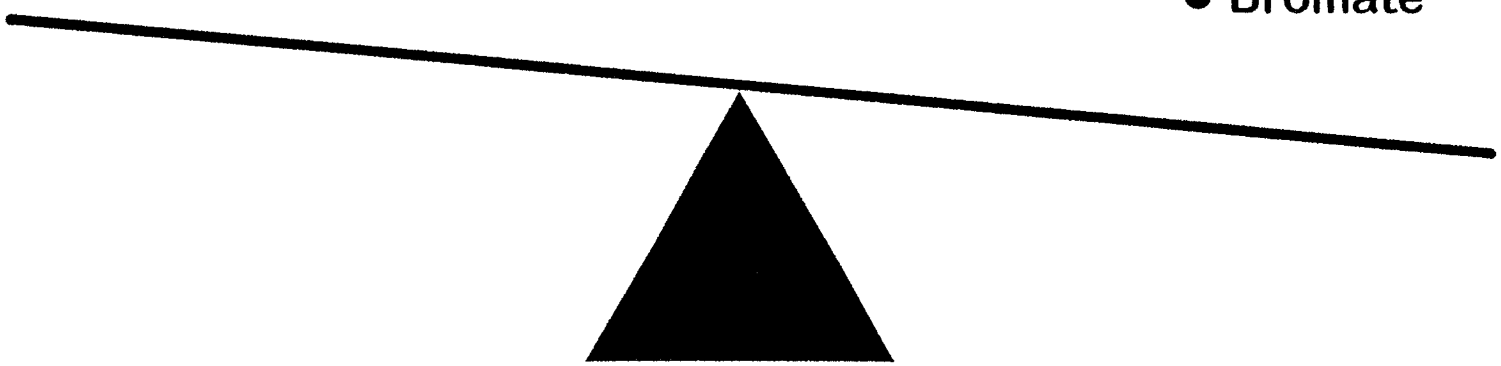
Figure 2 depicts increasing Delta water quality constraints as drinking water regulations become more stringent. For example, assuming a 90-percent inactivation of *Giardia* (1 log), the water quality from the Delta would need to be 3.0-4.0 mg/L for Total Organic Carbon and the bromide concentration would have to be in the range of 50-250 μg/L, depending upon the treatment technique. As additional disinfection requirements (2-log *Giardia*) are implemented, water quality required to allow ozone to meet these requirements must improve: TOC <3.0 mg/L and bromide <50-150 μg/L. Finally, if inactivation of *Cryptosporidium* is required, then ozonation is the only effective option prior to implementation of membranes and GAC and would require a very low bromide concentration (<50 μg/L) to comply with the anticipated standard for bromate.

Figure 1

Balancing Disinfection and Chemical By-Products

➤ Disinfection
- *Giardia*
- Viruses
- *Cryptosporidium*

➤ Disinfection By-Products
- T H Ms
- H A As
- Bromate



➤ Treatment
- Chlorination/chloramination
- Ozonation
- Enhanced coagulation
- G A C
- Membranes

➤ Source water quality

FIGURE 2

DELTA EXPORT WATER QUALITY AND TREATMENT CONDITIONS REQUIRED TO MEET REGULATORY SCENARIOS

	EXISTING OR PROPOSED REGULATIONS				DISINFECTION ASSUMPTION	TREATMENT**	DELTA WATER QUALITY CRITERIA
	THMs* (ug/L)	HAAs* (ug/L)	BROMATE (ug/L)	TOC* (mg/L)			
1979 THM Standard	100	None	None	None	None	Chlorination/Chloramination	None
Surface Water Treatment Rule SWTR (1993)	-	-	-	-	0.5 log *Giardia*	Prechlorinated/Conventional	Br < app. 400 ug/L****
Stage 1 DBP Rule/Interim SWTR (2001-2003)	80	60	5 or 10	up to 50% reduction	0.5 log *Giardia*	Enhanced Coagulation or Ozonation	not analyzed
Stage 2 DBP Rule/ Enhanced SWTR (2003-2005)	40	30	5	up to 50% reduction	1 log *Giardia*	Enhanced Coagulation or Ozonation	TOC 3-4 mg/L Br <50-250 ug/L
Stage 2 DBP Rule/ Enhanced SWTR (2003-2005)	40	30	5	up to 50% reduction	2 log *Giardia*	Enhanced Coagulation or Ozonation	TOC <3 mg/L Br 50-150
Stage 2 DBP Rule/ Enhanced SWTR (2003-2005)	40	30	5	up to 50% reduction	1 log *Cryptosporidium*	Ozonation***	TOC <3.0 mg/L Br <50 ug/L

*THMs = Trihalomethanes, HAAs = Haloacetic acids, TOC = total organic carbon
** Treatment assumes conventional filtration for ozone, enhanced coagulation options
*** Assumes ozone at pH 6.5
****Based on results at Metropolitan Water District

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